THE BOOK OF BREAD

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THE BOOK OF BREAD

BY

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(OWEN AND OWEN)

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etc., etc.

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PREFACE

ALTHOUGH almost incredible, it is now just upon twenty years since the first contribution from the author's pen appeared in the Trade Press. For fifteen years, since 1888, when first approached by the publishers of *The British Baker* and of this present work, the author's articles in that prominent journal have been quite continuous, as many as three having occasionally appeared in one weekly issue. During that long connection, a phenomenally large correspondence of many hundreds of letters, containing almost every conceivable inquiry concerning difficulties in the bakery business, have been received from throughout the British Empire, and these correspondents have many times suggested and requested the writing of a book. These requests have been followed by distinct offers from the present publishers, which in turn had to be refused, because the very secret of the success, as others say, attending these contributions, namely, the close association with the commercial side of the subject, has militated against obtaining the necessary time and opportunity for treating sufficiently well a matter of such importance, and entailing an immeasurably greater strain than the usual weekly article. Even the recent invitation to produce this "Book of Bread" as a suitable companion to the most excellent "Book of Cakes," was, after great consideration, declined with regret; but the truth, the whole truth, and nothing but the truth, is that, not until the author saw his repeated refusal was endangering the continuance of a long and valued connection, did he reluctantly yield to persuasion, and then proceed with all his might to arrange for doing thoroughly that which he had undertaken. Thus the origin of this book.

After reference to the extent of the Trade Press contributions, a word of explanation is due, concerning the name of the author of this work as given on its title-page. Anonymity is distinctly repulsive in all matters personal, but in matters technical it has considerable advantages. Both by correspondence and by many positions held, the author has been thrown into contact, in different capacities, with a large number of all sections of the trade, and, although always having the courage of his opinions when necessary, he has preferred privacy and reserve, not wishing to force them personally upon others, or to appear egotistical. He has also experienced great pleasure in discussing, and hearing opinions concerning his own articles, which, of course, could not have been so freely done had their authorship been recognised. The author's work has mostly been done under three distinct names, as of individuals, a unity in trinity, and although one of them had become known in well-informed circles, and is now announced on the accompanying title-page, the reputation of another is affording the author much satisfaction, pleasure, and amusement, especially when, as occasionally, some of the subject matter is quoted authoritatively to himself.

Amongst about 350 distinct books and pamphlets on this trade contained in *The British Baker* office alone, there are many excellent contributions by gentlemen who have been good enough to mention the author therein, such as those, taken at random, of Messrs Jago, J. & A. Kirkland, Blandy, Vine, Gribbin, Cobley, Vass, and Chidlow. On a different system to the above, it was originally intended to produce the author's own twenty years' contributions in the form of an Encyclopedia. The author started to read his own contributions and letters, classifying the various subjects in alphabetical order, which was rendered more possible by the excellent services of his assistant, Mr Frederick Pile: the extent, however, of the task being then

A PRIZE TIN LOAF.

more thoroughly realised, further reading of those contributions had to be discontinued, and others could barely be commenced, therefore the Encyclopedia idea had, for the present, to be abandoned. The various headings had to be rearranged into their present sections, and the book, already most expensive in production, and voluminous, now consists of an exhaustive treatment of merely the questions suggested by the author's own correspondents, which, however, by extending over so long a time and so wide an area, may be fairly taken as representing, and including, practically all, as seen by the index, the baker, in his ordinary avocations, would find useful or would desire to know.

The contents will be seen to include full information on the various ingredients and mechanical appliances used by bakers, concerning which the author is most constantly consulted. The good and bad points in a loaf of bread, and how they should be respectively obtained and avoided, are fully discussed. The two most important and unique features, however, clearly distinguishing this book from anything hitherto produced, are, firstly, the most expensive illustrations, which fulfil a promise arising from the publication of diagrams of exhibition prize loaves in *The British Baker* four years ago; and, secondly, the tabulated results, in the concluding section, of over 360 experiments, and different methods of bread-making, together with the results and the concentrated information of many years of close observation and experience.

Most of the loaves, that are photographically reproduced in colours, have been selected from those winning prizes at competitions, but others have been specially supplied for the purposes of this book by well-known gentlemen engaged in the family and wholesale trades; the author's thanks are therefore specially due for such loaves to Messrs Spiking & Co., London, bakers to the Royal Family, Messrs W. Skinner & Sons, Ltd., the well known firm of Glasgow, Mr A. L. Johnston, Wimbledon, the Chairman of the Educational Board of the National School of Bakery, Mr Peters, London, and Mr R. Marshall, of Bellshill, Scotland, the two latter gentlemen being also particularly known as prominent prize-winners.

In conclusion, the author hopes, by reason of his having performed the duties of an apprentice of an operative sufficiently long for his purpose, and of an employer, subsequently to his classical and scientific training, to have succeeded in here supplying the link between the bakery and the laboratory, in driving right home in simple language, to the needs of the baker and of the miller, when flour is too often blamed for other faults; and, further, the author hopes this humble effort will earn a reception by his clientele no worse than that accorded to his other productions of a more evanescent and desultory character.

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THE ILLUSTRATIONS

THESE illustrations which are distributed throughout the book are largely self-explanatory. We have before published diagrams of exhibition prize loaves, and at the time, four years ago, asked for photographs such as these, but were told that such would be far too expensive for the usual journal, and, moreover, at that date the present excellence could not have been attained. However critical readers may be, they will be forced to admit that never before have they seen such a complete collection of prize loaves illustrated in such an excellent manner. The author had originally no conception of the number of experiments with different processes, conducted at great expense of money and time, that would be necessary to produce the plates in their present condition. Trial after trial and proof after proof has been rejected as insufficiently satisfactory. One of the highest authorities on colour photography in the kingdom undertook to produce these illustrations by an entirely new process, but the great expense incurred had to be sacrificed, the result being less perfect than anticipated. It may seem strange to those unaccustomed to this work, that one of the chief difficulties has been to reproduce the whiteness of the crumb of the loaves, and that being so, preference for nearly all of the sections has been given to the ordinary photography. The loaves are now produced photographically correct, of exactly full size, and the colours are as nearly perfect as it is possible for them to be by any process at present known. The representations will at any rate answer a very large number of correspondents, who do not appear to visit the exhibitions, and write to know the style of loaf required in various classes, and as to whether their own is anywhere near the standard.

The 1st illustration is that of an excellent tin loaf to which we recently, in agreement with other judges, had the pleasure of awarding a first prize.

The 2nd is a section of the same loaf.

The 3rd is a section of a 2-lb. loaf from South Wales, being worse than the above only in texture.

The 4th illustration is that of a pan loaf with crumby and greased ends from Scotland.

The 5th is a section of a similar loaf.

The 6th is a prize English crumby loaf from Liverpool.

The 7th is a section of the same.

The 8th is a prize batch loaf from Belfast (Ireland) with greased sides.

The 9th is a typical Scotch square—the national loaf of Scotland.

The 10th is a section of the same.

The 11th is a section of a Scotch square, or crumby, or plain, that won the championship at one of the London Exhibitions.

The 12th is a splendid "Crusty Cottage" from London; made by one of the most regular of prize-winners.

The 13th is a coloured section of the same loaf.

The 14th is a beautiful bromide photograph (in the Edition de Luxe) of another champion cottage, after being exposed in the prize case all the week.

The 15th is a cottage loaf from Wales. It is, like all the other plates, a photograph in full size, and the peculiar appearance is due entirely to the tilting, so as to show the top.

The 16th is an English Coburg or Brunswick, selected as the best of its class in a recent competition.

The 17th is a section of same. In spite of the hole, which in a photograph is rendered exceedingly conspicuous, the loaf totalled more points than other poor loaves sent.

The 18th is a fancy or crusty brick. Observe the notches.

The 19th is a section of a typical French loaf from Scotland baked in a shallow pan.

The 20th, 21st, and 22nd are photographs taken at *The British Baker* office, by its own photographer, of various shapes of bread that were recently received from all parts.

The 23rd is a disreputable so-called fancy brick taken at same time.

The 24th is a typical Irish batch, plain or turnover loaf, that was awarded a prize at last year's London Exhibition. Originally taken full size, but reduced now to exactly half, because too large for the page.

The 25th is a section of the loaf that won first prize in the "Malted Brown" class at last year's London Exhibition.

The 26th is the usual wheatmeal loaf supplied by a gentleman of distinction doing a first-class family trade.

The 27th is a section of a milk loaf supplied from the same establishment.

The 28th is a collection of Vienna bread ordinarily supplied by a first-class London firm, which is also distinguished in this department at exhibitions.

SECTION I

INGREDIENTS AND THEIR USES

"Content, if here th' unlearn'd their wants may view,
The learn'd reflect on what before they knew."

POPE.

MALT AND MALT EXTRACT

MALT consists of barley or other grain, such as maize and rye, that has been steeped in water till it germinates or sprouts, then dried as on a kiln; and is interesting to bakers because of its use for making home-made or patent yeasts or barms, and, more particularly of late, because of the various kinds of extracts from it that are supplied to the baker in a concentrated form.

Although the use of malt by the baker has greatly lessened in some districts owing to the admirable supply of ready-made yeast, it is still much used in others, such as in Scotland and the colonies, with which the author has much correspondence. Not only is the quantity of malt, when making patent yeast, of importance,—the more the malt the better, all things equal, and the stronger the yeast,—but also the quality and character. The best for bakers is a short, crisp, and pale malt, and not one that is hard, steely, dark, or highly coloured; the latter often contains less extract, and is worse colour for the bread. A baker requires a malt that has been slowly dried or kilned, not being overheated, but well ventilated, so that its moisture would be well removed by the draught, enabling it to break up in the hand easily. If too quickly dried, and without a good current of air to carry off the evaporating moisture, it will be hard; but if the superfluous water be driven off from the start, and the heat be gradually and slowly raised, it will be more mealy, as it should be, whereby more small granules of starch, in proportion to large ones, are present, and also more diastasic properties, the strength of the latter varying very much in different malts.

If the malt should not be good the subsequent mashing must not be above 158 or 166 degs. F., and the heat must rise slowly, otherwise the starch would become scalded, which takes place at 10 degs. below this, and the barm immature. Some prefer the malt ground coarse, because the mass would more easily keep porous; but we have noticed that some distilleries that we have visited use a finely-ground malt, and consider it better for yeast growth. About a ton namely, 2240 lbs., of malt extract can be obtained from 10 quarters, namely 3360 lbs., of malt. When making malt extract, the malt should be moistened for two or three days, the water being thoroughly mixed with the malt; then should be spread out and kept fairly warm, whereupon it sprouts, that is, its germ begins to grow in the same way as it would if sown in the fields, and pushes a sprout through the side of the grain, feeding on the interior starch and other bodies. Something of the same thing happens when wheat at harvest time is left in the fields after being cut, and cannot be carted because of wet weather; and the growth and the damage will be more if the weather be warm and sultry than if colder. During the malting or sprouting, special ferments are developed and convert the starch of the grain into sugar. The ferments and sugar are wanted in malt, but their formation and the growing of the germ must be stopped at the right moment, or else the products formed will be consumed. This growing is stopped by heating which, however, must be high enough to kill the germ without killing or weakening the ferments, the one with which we are concerned being called diastase. When the growing of the germ is stopped and the conversion of the starch into sugar is complete, the originally raw grain has become commercial malt, and must then, for the purpose of extracting all the soluble matters thus formed, be well steeped in water, this then, after being strained, would be an extract of malt. The pro-

Section of Prize Tin Loaf.
(ACTUAL SIZE.)

portion of water present, however, by reason of its bulk is naturally inconvenient and expensive for purposes of transport, and such would render it unprofitable or else bad value. This would finally, in spite of advertisements, interfere with its sale in the same way as similar circumstances have done in the case of patent yeast, that used often to be brewed at a central place and carted round to bakers, as the brewers' thick and the dried yeasts now are. It is necessary therefore to concentrate the extract by driving off much of the water by boiling, but boiling in the usual way, which would be at a temperature of 212 degs., would kill all the ferments and diastase contained therein, therefore this thin extract is placed in a vacuum pan, in which, by the air pressure being reduced, it will boil and concentrate at a low temperature, which should not exceed 130 degs. F.

There are really two separate classes of malt extract obtained according to the details of mashing or manufacture. One is more expensive than the other, even when made from the same malt, and should be used by the baker in different quantities and for different purposes. The one is, where the mashing of the malt has been conducted at a low temperature, say at 65 degs. F., whereby good colour is obtained and also a good amount of the ferment diastase in its most active condition; the other is where the mashing has been conducted over a longer period, at a higher temperature of, say, 130 to 150 degs. F., whereby practically all the constituents of the malt are rendered soluble. In the latter case the diastase becomes exhausted by being required to convert or change all the starch into soluble matters such as maltose, but in the former the starch is practically unchanged. It is obvious that the former, or cold water extract, namely, extracting at a low temperature, will yield very much less bulk of material, therefore costs more to manufacture and sell. It is strong in diastase and proteids, or nitrogenous matters, and lower in maltose or sugar, and the extract obtained at the higher temperature, although from the same quality of malt, is low in diastase and proteids, and high in maltose or malt sugar. As to which is better value to the baker depends on the purpose for which it is purchased, and it will at once be seen how ludicrous it is to indiscriminately buy these comparatively modern products without knowing their constituents, and using them, as many do, without settled purpose, merely hearing that malt extract is a good thing, and without any consideration concerning the process of fermentation employed, or the character of the flour.

A little knowledge is a dangerous thing, and we cannot help again mentioning a rather old joke, because the circumstance has happened again to us during the last few days, namely, of a correspondent asking how much diastase he should use as he was going to give it a trial instead of yeast. It is true that both yeast and diastase are called ferments, and are also used in what, by its action, is called in the bakehouse a ferment; but yeast is a living plant, whereas diastase is merely a soluble albuminoid, and a result of germination, possessing digestive properties. It is the strongest and best known of the family of unorganised and hydrolytic ferments called enzymes. It is present naturally in malted grain, being largely and chiefly produced by the germination of barley, and to a less extent in wheat. It is present in barley in quantities of less than 1 per cent., yet is supplied in tins, with other products, as a concentrated solution of a syrupy nature, of sufficient strength to necessitate the use of only 4 to 8 ozs. to a sack of 280 lbs. flour, according to the make, at a total cost of fourpence-halfpenny to sixpence. These quantities do not refer to some commercial malt extracts that contain very little of the active principle diastase. Contrary to some other ferments of its family, such as invertase, diastase acts on the starch of bread in a very marked degree, one part of diastase in good condition being able to convert about 2000 parts of starch. Under favourable conditions of temperature it will succeed in converting most of the starch exposed to its influence into maltose sugar and dextrine or gum. Its ability to thus digest starch, whereby a great portion of the product is maltose, and also the close similarity of its action to that of the digestive ferment, ptyalin, contained in human saliva, is the main cause of its importance.

The formation of maltose sugar, with small quantities of dextrine, gives a characteristic flavour and moistness, and indirectly improves the size and colour (as noticed in some instances) by reason of the stimulating action which maltose has on yeast, which therefore more quickly and thoroughly (where the time is limited) does its work of aëration. During the stages of fermentation yeast feeds on maltose for the purpose of supplying alcohol and carbon dioxide, as is seen by the decrease in the specific gravity during the progress of a malt wort. It is therefore evident that if yeast, instead of obtaining its maltose by starch conversion, has it supplied ready for use, much work is saved. On the other hand diastase, unless accompanied by yeast, is unable to have action on starch cells that are not cracked, nor have their contents scalded or gelatinised. Starch is not gelatinised at a much less temperature than 149 to 153 degs. F., therefore, except as regards the few starch cells that become cracked or fissured by other means than hot liquor, diastase has generally been considered as being little use as a yeast stimulant, beyond the amount of saccharine matter that might often accompany it. Although starch gelatinises as above, and thus allows the diastase to attack it at that temperature, we must remember that diastase itself is killed, or ceases to act, when above the temperature of 175 or 180 degs. F., and, moreover, works at its height in a temperature of 40 to 50 degs. less. It is therefore seen that the margin of time at the disposal of diastase for this conversion during baking, is the time that would be necessary for the loaf to ascend from the temperature of about 145 degs. F. to that of about 180 degs. F., or through a minimum of 30 degs.

We have referred above to the different constituents of malt extract according to the method of preparation, and also to the period at which diastase can attack the starch—subjects on which questions are frequently asked. Although one does not see much on these points in the bread-making press, we have an immense amount of papers concerning them, written by the most eminent men, and produced in the Chemical Society's Journal. We have just been reading some of these papers by Morris and Ling, and the following short particulars give good information on several points that have just been discussed.

When diastase from well-grown, low-dried malt is allowed to act on starch paste or soluble starch, the starch is hydrolysed in about 1½ hours, whilst after forty-two hours the products are substantially those of maltose, and in such a solution nothing but maltose can be detected. Diastase prepared from malt grown under abnormal conditions (such as small quantities prepared in the laboratory) and diastase which has been slowly heated to 115 to 120 degs. do not hydrolyse the starch completely to maltose, even if allowed to act in large excess: diastase which has been rapidly heated to 115 to 120 degs. produces a more pronounced effect.

Neither the final temperature at which a sample of malt has been kilned (considered alone), nor the "diastatic power" determined in accordance with Kjeldahl's "law of proportionality" by Lintner's method, is a criterion of its behaviour towards starch. When a diastase solution is heated above 65 degs., its reaction with starch paste appears to be quite different to that of a solution which has not been heated above 60 degs.; this is shown, not only by the specific rotatory and cupric reducing power of the dissolved matter, but also by the presence of dextrose among the final products of hydrolysis.

A number of estimations of the "diastatic power" of malt were carried out in order to test the accuracy of Kjeldahl's "law of proportionality." It was found that the law does not hold either for green malt or for low-dried malt when their extract is allowed to act on a solution of starch at the ordinary temperature. The "diastatic power" as usually estimated may be misleading, since in order to meet the requirements of the "law of proportionality" only very dilute solutions of diastase should be employed.

When yeast is allowed to act on a solution of starch-conversion products in the presence of active diastase, the quantity of matter fermented is greatly in excess of that which can be fermented by the yeast alone; and when active diastase and yeast are allowed to act conjointly on the so-called stable-dextrine, which, under ordinary conditions, is neither degradable by diastase nor fermentable by yeast, it is entirely fermented.

It is now shown that a similar action takes place when certain ungelatinised starch-granules are submitted to the joint action of malt extract and yeast, the quantity of starch decomposed by the joint action being about three times that dissolved by malt extract alone. The increased action in the presence of yeast is not due to the removal of the soluble product, maltose, from the field of action, and the consequent greater activity of the diastase. No increased diastatic action takes place in the presence of yeast if the fermentative power of the latter is checked by chloroform, neither does any increase of action take place when the malt extract is submitted to fermentation, and the yeast-cells removed, before the addition of the starch-granules.

Precipitated diastase behaves in the same way as cold water malt extract, but to a less extent.

The combined action of diastase and yeast only occurs with those starches which are attacked in the ungelatinised form by diastase, such as barley or malt starch. The granules of potato starch, according to the same authors as above referred to, are not acted on by diastase even in the presence of yeast.

It is therefore seen that the constituents of malt-extract vary, but the following is an analysis of one that has attained popularity :—

Nitrogenous matters (including diastase)	13.39
Maltose and glucose	50.95
Dextrine	6.61
Ash	5.36
Water	23.69
	100.00

When a malt extract contains a large degree of diastasic strength, 4 ozs. per sack of flour, as sometimes used, will have as much effect, as regards mellowing the flour, as would 1 lb. of another sort, which was low in diastase and high in maltose. The former, by acting on the flour, is best in the later stages of fermentation ; and the latter, by being directly fermentable by yeast, is best, as a rule, in the prior stages. If only one stage, the user must be careful to add no excess, whereby there would be undesirable quantities of maltose and dextrine, which would make the bread sticky and clammy and difficult to bake. This stickiness, however, would often decrease as fermentation was allowed to proceed further, being consumed by the yeast, as can be proved by adding excess and baking portions of the dough at varying periods. Practically all the extracts on the market have an effect on the degrading of the flour or the feeding of the yeast, and are therefore quickeners of fermentation. As such, they have mostly been found useful in mellowing or peptonising and ripening harsh and strong flours, but with soft flour and a long process there is usually quite enough, if not too much, weakening already. Instead therefore of any further weakening it would be better, on the contrary, to give more salt, more labour, and something of an astringent nature, such as was once supplied by alum when the wheat was soft and malted in the fields.

The ferments produced in wheat when sprouted or malted in the field, or in any raw or imperfectly malted grain, are of a weaker and lower order than properly prepared diastase, and cannot be placed quite in the same class by having less action on soluble starch, but they have action on gluten. In soft flours there is thus sufficient soluble matter without further adding about 6 to 10 per cent., as would be done by malt extract during the bread-making process, some of which would be consumed by the yeast. Flours at one time were nearly all too soft ; a few years ago many were too harsh ; now, at the present moment, they are about normal. When too harsh, they can be improved by a judicious use of malt extract in flavour and moistness and also sometimes in bloom, because they can well do with the characteristic action of malt extract, namely, having their starch reduced and their soluble matters increased. The statement, as sometimes made, that malt extract prevents sour bread is risky, because with speed increased, and the time not shortened, the opposite would be the case. With harsh flours and short processes, the best way to use malt extract is to add it to a little scalded flour, and then stir in yeast and strain into trough for incorporating with rest of batch. With long processes, it is best to keep the malt extract out until last or dough stage, because in such processes as in Scotland any such quickener, where there is already a lot of soluble matter, would require much watching, or would be likely to produce harm. If used earlier, the proportion of flour in those stages should be increased, and the quickening allowed for subsequently.

Although distillers' yeasts are quicker than barms, it is frequently found that in the Scotch process they will stand more malt extract with less effect, because when used the process is often considerably decreased in time, and has not the soluble and malt principles as would be the case with the barm. And also more can often be used in the case of Parisian barm than compound. Although in the greater portion of England, with most of the malt extracts on the market, it is customary to use about $\frac{3}{4}$ to 1 lb. per sack of 280 lbs., we were recently concerned with some tests that were made for the purpose of demonstrating the value of a kneading machine, and conducted by American bakers, who added 3 lbs. to the batch of one barrel (196 lbs.) or less than three-quarters of a sack. The two cheapest constituents of malt extract are glucose and water, and the amount used per sack and the value must depend largely on these. A rough guide concerning concentration and quality can be obtained by seeing to what extent it will run to fine threads when pouring. Glucose being a cheap sugar, and a yeast food of less cost than malt extract, is in some cases added largely, and should not exceed about one-quarter or one-fifth the amount of maltose; the amount that would be naturally present being less rather than otherwise, but according to the process.

One is often asked if malt extract is a good substitute for potatoes. As in the case of the advantages or disadvantages of malt extract, according to the class or the manner of its use, so is it with potatoes. In the case of a sponge or dough they can be easily discontinued with or without a substitute, but in the case of a ferment (not the modern short one of just half an hour or so merely to start the yeast, but the larger and longer one for the purpose and absolute necessity of increasing a small quantity of yeast in order to do subsequently the work of a larger quantity), it is not reasonable to suppose that 1 lb. of liquid material will, under those conditions, be the same all round comfort as, say, the previous 14 lbs.

of potatoes. It is just the difference between a piece of beefsteak and a cup of Bovril. One may be an extract from the other and possess all the nutriment, stimulant, and good constituents in a handy and more convenient form, but it has not the bulk of matter, it is more readily consumed, digested and forgotten ; and has not the same amount of stay or lasting effect. An extract of potato or an extract of flour would not make so good a ferment when required to be long and steady and progressive, as would the bulk of potato or bulk of flour, and an extract of malt on the same lines will not take the place of the crushed or entire malt, or other bulks of material. The extracts should be made more steady and filling in their effect, by having added to them portions of scalded and also raw flour, in order to represent the cells of the potato that had been scalded during cooking.

The principles affecting flavour, moistness, and yield of bread are discussed under their respective headings.

Malt, and the matters extracted from it, is a very old acquaintance of the bakehouse, and should therefore be better understood by the average baker than it appears to be in its new form. When first it came under notice in its new form the baker was asked to pay a royalty to the patentee, and to buy the utensils for the purpose of making it himself under the patented process, but the manufacture, although easy enough when understood, requires skill, plant, space and knowledge, and like wheat buying, yeast brewing and biscuit making, all of which were once in the hands of the baker to a very much greater extent, has passed largely into the hands of more distant specialists.

During the interval between writing the above and the reading of proofs, we have come across three very long articles, which we wrote over ten years ago, in a very much more advanced style than is considered politic for the present book. Some of the same ground has been covered in the present contribution, but a summary of those articles in so far as it adds to what has already just been said, can be advantageously appended, as follows :—

The embryo (germ) derives its food from the endosperm (starch), the

Section of Good Commercial Tin Loaf.
(ACTUAL SIZE.)

latter being merely a dead storehouse of reserve material. The resting embryo contains no diastase ("of secretion"), but the latter appears during germination, and is secreted by the epithelium cells—by them only—and accumulated for the most part in the endosperm (from the nitrogenous matters of which it is first produced) in proportion to the development of the grain. The enzymes (diastase, etc.) of the embryo degrade the starch cells, making them "mealy" in the same manner as the diastase of malt, and the resistance to their action depends on the "condition" of the grain. Embryo can be easily separated from the endosperm, showing there is no organic connection. The aleurone cells (sometimes called gluten cells) under the bran contain fat and oil, therefore much nutriment, but resist human digestion. The starch and its envelope of cellulose are dissolved respectively by two distinct enyzmes or ferments, the amylo-hydrolyst (diastase) and the cyto-hydrolyst. The word diastase, like the word gluten, is often used ambiguously. The more highly active form of diastase should be called "diastase of secretion," and the other less active form should be distinguished as "translocation diastase." The resting embryo, unlike the germinating embryo, is often said to contain "no diastase" by reason of its containing none of the powerful diastase of secretion, but it nevertheless (although for a long time overlooked) possesses the properties of the less active translocation diastase. During the developing of the embryo (as opposed to, and, of course, preceding its germinating) translocation diastase is produced, and the unused residue of it constitutes the diastase of the resting embryo. The difference between these two diastases is that the diastase of secretion is easily able to liquefy starch paste and to erode the starch granule, whereas the translocation diastase is unable. These two diastases might also be respectively classed as the diastases of raw and germinated grain, or also barley diastase and malt diastase; the former works worse at high temperatures, but better at low temperatures than the latter. When cane sugar is present the epithelium cells secrete no diastase; the embryo must first use the cane sugar or any other easily absorbed food before secretion takes place. Cane sugar promotes better plant growth than dextrose, maltose, or milk sugar in the order named. The amount of sugars increase, but starch decreases during germination.

POTATOES

THE potato tuber, which is often spoken of in the trade as "fruit," has been a friend to the baker for generations, and although being now, with good reason, rapidly forgotten has still some supporters. The author, practically throughout his life, has been strongly against their use and well remembers an insistence on their discontinuance costing him services of an excellent foreman, who was the first he ever employed. They are not convenient and are not as cheap as they seem, they have no properties that cannot be as well supplied in other ways, in fact modern methods are such that there is no need for them. Where substitutes are tried and not found as good, it is because they are not properly understood, and an instance of this is considered under the heading of malt extract. Whatever advantages potatoes may be considered to have are outweighed by disadvantages. Millers spend thousands of pounds in order to remove all dirt and impurities from the flour, yet the users of potatoes, even if they carefully clean them themselves better than the odd boy would do, put in a considerable amount of dirt, as can be seen by comparing the colour of the potato liquor with that of clean water. Dirt is always present and oftentimes disease as well, especially in bad years, and the most careful overhauling will not always eliminate it. The supposed cheapness does not pay the trouble and labour. The best that can be bought, such as one would use for the table, are the cheaper, as there is less waste, and better result. They should be of good size and mealy, and not too watery or spotty, and should not be of the class known as "Bakers' Potatoes."

Let us see the difference in price and convenience between scalded potato starch and scalded wheat starch or flour. Do raw potatoes per pound cost more than flour per pound to buy? There is not the difference there used to be. The potato consists of about 75 per cent. water, 17 per cent. starch and sugar, 5 per cent. albuminoids, and about 1 per cent. each of fat and ash. The flour, on the other hand, consists of about 12 per cent. of water, 73 per cent. of starch and sugars, 12 per cent. of albuminoids, and similar quantities as the potato of fat, ash and cellulose. The starch, sugar and albuminoids are not only useful foods, but also are more profitable to buy than water, and it is clearly seen above how much water is bought in a potato. Not even the 25 per cent. of solid matter in the potato all finds its way to the bread, as there is the skin to come out of it, and if insufficiently cooked there will be a quantity of potato left adhering to the skin after straining, and this waste and skin all come off that 25 per cent. In addition, some potatoes get bad and are discarded, or, worse still, are not, and the price of the dirt bought with them, and the cost of removing it when bought, shows a great contrast to the pure, clean flour, which arrives all ready for use without waste and with but little water, and can be instantaneously cooked. The slight advantage the potato has over flour as regards the soluble albuminous matter is nothing, under the circumstances of to-day, compared to the advantage of flour over potato as regards starch and everything else.

The way to see the truth of the above is to let the matters extracted from the potato settle, pouring off the superfluous water or evaporating the whole to dryness and weighing the sediment, which will be found to be much less than anticipated. This sediment can be bought already prepared in this manner under the name of potato flour, and contains the whole of the matters of the potato, the starch as well as the nitrogen, as against potato starch which contains only what its name implies. Potatoes vary in strength according to season and also according to age, but the solids of such a potato flour when refined and purified would contain nearly 99 per cent. of starch, and about ½ per cent. of mineral matter and ¼ per cent. of albuminoids. A pound of it would equal fully 10 lbs. of potatoes as ordinarily purchased and would absorb about ½ a gallon or 5 lbs. of water. With the addition of raw flour, scalded flour and malt extract, no better yeast food for ordinary purposes would be wanted, and the saving in colour and trouble and risk would be great.

The boldness in the loaf attributed to potatoes is only due to an increased vigour of fermentation by the food they supply, which in some cases, according to conditions, might be missed if not supplied in another way. If a sufficient quantity of yeast is used it will find plenty of opportunity of getting food and making gas, which, in conjunction with gluten and proper management, is what makes boldness or bulk. When yeast could not be bought cheaply in a concentrated form, but had to be grown more largely in the bakehouse, the circumstances were different. The moistness claimed is due to their scalded starch cells during cooking. A wheelbarrow is a handy thing in which to carry a man home when he cannot walk, but it is not needed if a better conveyance can be obtained; the simile applies with force to the purpose once served by potatoes and for which they have now been superseded.

Not only are potatoes said to have deteriorated in quality because they are cultivated from tubers and not from seed, but there have recently been traced to them cases of poisoning, and one begins to wonder if by-and-by any food will be left unassailed. This poisoning is attributed to an active principle known as solanine which can be extracted from the potato fruit and belongs to the poisoning class. It is certainly present in the potato fruit but it is more difficult to say if it is present in the potato itself. It may occasionally develop in the skin, and is found also just under the skin, and will sometimes give a rank and bitter taste. We have known many cases where there was a bitterness in the bread, that has been traced to the ferment being left too long, and where brewers' yeast or hops had not been used, and where the bread was the picture of health and did not show the slightest signs of over-fermentation, such as referred to in another place. We have also known on the other hand ferments, especially at Bank holiday times, that have stood a surprisingly long while without taking any harm or bitterness, but the precaution, be it noted, was taken to strain the potatoes and set the ferment without the skins.

SUGAR

THIS well-known sweet crystalline substance is obtained from the sugar-cane, and also the beet, maple, and other plants. These canes are about an inch thick, and grow to a height of 10 or 20 feet, the hottest places producing the best canes, and 100 of them will yield about 70 lbs. of sugar.

The canes are first crushed and the juice squeezed out. The extracted juice is mixed with quicklime, and also boiled; during boiling the impurities float to the top and are skimmed off; the crystallised is separated from the uncrystallised. The crystallised or crystals are ground, in much the same way as wheat is ground and refined into flour, into various grades of commercial sugar, one grade differing in colour very much from another from the same crystals, such, for instance, as castor sugar and icing sugar, merely from increased fineness. As in flour, the whiter or lighter the colour the purer would be the sugar. The uncrystallised, or the sugar that crystallises with difficulty, is sold as treacle, or golden syrup, and is very sweet, containing sometimes as much as one-third glucose to two-thirds cane sugar. Small quantities of treacle, or golden syrup, can be added to brown bread. The sugar known as "pieces" is a lower grade, corresponding to a low grade flour, containing more water and being worse colour. The highly refined sugars contain as much as 99 per cent. of sugar.

So-called cane sugar is not necessarily sugar from the juice of the cane, but refers to any sugar of a high class with the same characteristics, irrespective of its source. Moreover, it is practically impossible to distinguish between the pure sugar from the beet of France and that from the cane of the West Indies; it is only when the beet sugar is not sufficiently highly refined that any difference can be noted, and then by the taste. Cane sugar is very stable, and not therefore directly fermentable by yeast, but must be inverted into glucose. Glucose, as discussed under a separate heading, is a lower form of sugar, and can be produced from soluble starch, etc., by acid as well as yeast, and is then cheap. There is a difference of opinion as to whether glucose or cane sugar is the sweeter. Sweetness is not necessarily an indication of sugar, because saccharine, which is often used for sweetening, being very much sweeter than cane sugar, is associated with coal-tar, and has no connection whatever with the carbohydrate family of which sugar is so important a member.

The cheaper grades of cane sugar sometimes have rather considerable portions of glucose added, and the presence of the latter can easily be discovered by its well-known action on Fehling's solution, whereby a red coloration or precipitate is formed, according to the amount present, whereas pure cane sugar gives no such coloration. This glucose, sometimes called grape sugar, when bought at glucose price, is one of the best sugars for adding to bread, and 1 lb. per sack is suitable for average results. There is sugar contained in malt, known as malt sugar or maltose, also sugar contained in milk, known as lactose, therefore the amount of other sugar added per sack must depend on whether malt extract or milk be used at same time, and also on the process of bread-making, and the quality and character of flour. Anything from ½ lb. to 2 lbs. of total sugar per sack can be added, according to the above conditions, but too much will often make the ferment or sponge fret, and 1 lb., as in the case of glucose, will usually be found enough. In the case of making buns, the whole of the sugar required for the bun when put in the ferment will sometimes have a restraining instead of a stimulating effect, by reason of being in excess, and it is best to divide the sugar equally between ferment and dough. A quart of water, when cold, will dissolve and hold in solution about 5 lbs. of sugar, and more when heated, the specific gravity of sugar being about 1.6 ; but a solution containing anything like 30 per cent., or one-third, will hinder yeast sown in it, and should not exceed 5 or 10 per cent.

The sugar naturally present in good average flour is from 2 to 3 per cent., in about equal proportions of cane sugar, sometimes called sucrose, and maltose ; the softer and less stable flours will contain more maltose, and, in some cases, also glucose, and the harder and stronger flours will often contain less maltose and more cane sugar. For the purposes of bread-making it is not necessary to consider the various changes that take place in the character of sugar during boiling to different degrees, as required for the various goods of the confectioner, but while boiling, as in the case of the original juice, a scum will often rise, and the greater the amount of it, the worse will be the quality of the sugar. When heated to about 400, as in an oven, sugar produces caramel, or caramelises ; that is to say, a dark brown substance is formed.

GLUCOSE

GLUCOSE is a low stage of crystal sugar, and is made from flour during fermentation ; but it can also be converted or made from starch, maltose, and dextrine, by acid without yeast. The acid usually employed is sulphuric or hydrochloric (or muriatic, as it is sometimes called), and this acid sometimes contains arsenic, as has been the case in the recent north-country beer-poisoning cases. It is cheaper to make this fermentable substance—glucose—by acid from ordinary commercial starch, from maize, or rice, than to make it from wheaten flour or barley malt by the gradual action of yeast. Glucose being a substance produced by change, is therefore, according to its percentage in a substance, a guide as to the amount of change that has taken place. When tested with Fehling's solution, the precipitate formed is of a bright red or brick colour, more so than in the case of maltose, the amount of precipitate being in relation to the amount of glucose. In the volumetric estimation of glucose, and also of invert-sugar, the author finds that the final point can be observed much more readily if the saccharine solution is alkaline and not acid. It is therefore advisable, after the inversion of cane-sugar by means of hydrochloric acid, to neutralise it, or render it alkaline, with potash before titrating with Fehling's solution. This substance is very soluble in water, and being directly fermentable, is a good yeast food. It has a similar effect, as regards moisture, to malt extract, but it is sugar only, containing none of the nitrogenous matter or ferments, such as diastase, of the malt. It is sold in solid or liquid state, and is very cheap. The liquid, although a higher price, is preferable to the solid.

SCALDED FLOUR

FLOUR, or starch, is said to be scalded or gelatinised when, by the application of water of certain specific temperatures, its cellulose or outer covering swells and then bursts, liberating the interior and becoming soluble so as to form, when cool and sufficiently concentrated, a jelly-like mass. This change of state is familiar to most people in the form of blanc mange, which is merely the starch of maize, commonly known as corn-flour, after being scalded, and is altogether different from the result of mixing starch with water of a moderate heat. Ground rice, or whole rice, after being soaked, and several other starches, used in special instances, can also be likewise treated so as to become a yeast food or be added to the bread for other purposes. The range of temperature within which the substances likely to be used for this purpose becomes scalded, is from 120 to 160 degs. F., according to the class of substance, and its quality and condition, the larger cells or granules bursting, as a rule, sooner than the smaller. Potato and rice, however, both burst before flour, the first being larger and the second smaller. In order to avoid a very frequent disadvantage, namely, lumps, the flour or other material that we know to be used, in the Midlands especially, should be sifted, then mixed to a perfectly smooth batter with warm water—no more of it than necessary—and not hot enough to scald, but as near the scalding point as possible, so as to simplify what follows. Divide the water with which about to scald into three portions, adding to the batter in three instalments, stirring vigorously all the time ; and this stirring and gradual adding of water is the important part which is often neglected by those not accustomed to it, but never by the Scotchman who understands this work. The first portion of water should certainly be

SQUARE TIN LOAF.

boiling, and, perhaps, also the others, but if the quantity and heat of the batter be known, the remaining water can be regulated to keep the whole nicely above 160 degs., and beyond that there is no advantage; but, on the other hand, the soluble albuminoids, or the diastasic properties of the flour, become coagulated, like the white of an egg, and lose their action, and the whole degraded more than necessary. When well stirred, so that all the starch becomes burst and the whole smooth and cool, some malt extract can be dissolved in other water and added, whereby the whole will become sweet. Raw flour would help to cool and also have some small effect like malt extract. By the time it has stood a little it will be cool enough for the yeast to be dissolved in other water and added. When added to the other liquor of batch, it should be strained through a fine sieve, so that nothing, unless thoroughly dissolved, can find its way to the loaf. Other details must be arranged according to the utensils and process employed and the amount requiring to be prepared.

We like 2 lbs. or 3 lbs. of scalded flour to a sack of flour, and should not recommend anyone to exceed 10 lbs., which is too much for most circumstances, although we recently had 13 lbs. per sack in a tin loaf that was good, light, and sufficiently soaked. The amount advisable depends on the care and skill exercised and individual circumstances, and should always be very small at first trial, being increased gradually. The larger amounts require more care than usually given as a permanency, and if they do not show in the crumb in respect of lumps, they must, especially in conjunction with malt extract, reduce the quality and strength of the flour. Where the flour has no quality to spare, and the whole process is conducted with no more care than often-times, and also with the least possible labour, the crust, as well as the crumb, will show the added material, when in good quantity. Although short eating when well baked, this crust will be grey, dull, and poor, as in the case of over-ripe bread. With a short process, best grade of flour, plenty of yeast, and gas to ærate, extra salt to toughen, and the dough made up into tins, one, of course, can more easily get the advantages of scalded materials as regards moistness, whiteness, and increased yield without the disadvantages, according to quantity used, of heaviness, general poorness, and crumbliness. We once received a most satisfactory loaf from merely average country flour from an inventor of a special method in this connection, who, as advertised at the time, had succeeded in perfecting his process so as to avoid the pitfalls. The scalded material should be used fresh, and not allowed to get sour. Further information bearing on this subject will be found under the headings of dryness, colour, crumbliness, and yield.

GLUTEN—THE CHIEF CONSTITUENT OF FLOUR

THE gluten of a flour is its most valuable and important constituent, as it is the one substance that distinguishes the characteristic properties of wheaten flour from the flours of other cereals. It is not only the substance that is chiefly responsible for the bulk and the lightness of a loaf, but it is also of a very nitrogenous or nutritive value. It exists throughout the interior portion of the wheat berry, but it does not seem to be present in flour in its characteristic state until water is added and the flour made into dough. It cannot be separated from flour as an adhesive and sticky substance without being wetted, although the indication of its presence can be obtained by ascertaining the nitrogenous ratio in the flour by chemical reagents. There is a layer of cells just immediately inside the bran, or outer coating of the wheat grain, which are called gluten cells; these, however, do not contain gluten in the same sense of the term as it is now universally used. At one time it was customary to class all albuminoids or nitrogenous matters together, under the term of gluten, whether they were soluble or insoluble. These so-called gluten cells, sometimes called cerealine cells, contain phosphates, fat, cerealine, and soluble matters, but none of the insoluble.

When flour is wetted into a moderately slack dough, and allowed to stand about an hour, and then washed between the fingers under water, the starch of the flour will flow away, leaving in the hand the adhesive and tenacious substance known as gluten. If this be squeezed so as to free it from its loose water, a good average and suitable bread-making flour will be found to contain about 35 per cent. (30 to 40). Within certain limits, the higher the percentage, the better the flour for bread-making purposes, but sometimes there is found a very abnormal percentage of 50 or even 55 per cent., which is not desirable. A big quantity can sometimes be obtained from badly-matured grain, but its quality is such that it soon gets soft and sticky, and has not the elasticity as desired for good bread-making purposes. This lump of gluten, when freshly extracted from the flour, is known as "wet gluten." In order, however, to ascertain its percentage, apart from the water absorbed, it should be put into a slow oven, preferably one heated, as in laboratories, by a jacket of boiling water at ordinary pressure, whereby the heat does not vary, and does not get excessive. In about twenty-four hours the gluten will be entirely freed from its water, and then be known as "dry gluten," which is always about one-third of the wet, but varying slightly according to its water capacity. Dry gluten in flour can vary from 6 to 15 per cent., and represent flours that are serviceable for various purposes. There are wider differences than these, as mentioned in the case of the wet gluten, but a fair average for soft flours would be from 6 to 9 per cent., and for strong flours from 9 to 16 per cent.

Quality, however, of the gluten in flour is just as important as the quantity, and the quality depends largely on the percentage of its constituents. It was at one time considered that gluten was an elementary substance, having no constituents of which one need take particular notice. The percentage of these constituents is now found to account for practically all the differences in the bread-making qualities of flours, although of similar percentages of total gluten. These constituents are usually now named gliadin and glutenin, which are comparatively new terms. The students who, some years ago, attended the early classes in bread-making, will remember the author drawing special attention to them as glut*i*n and fibrin. Not only are there wide differences in the percentage of gluten in different flours, but, according to the skill and method of the operator, varying results will be given for one and the same flour. This is particularly noticeable when people first begin to use this test, and think they know all about it. The differences noted, according to the time the gluten stands and the amount of its washing, when estimating the total gluten, are, however, wider and more important when separating total gluten up into its constituents. Many of the analyses conducted by recognised authorities and men of the highest skill are conflicting, as the following will show. Fleurent's estimations of glutenin and gliadin differ remarkably from those of Osborne and Voorhees, who were the first to make this separation in this particular form, and to use the terms "glutenin" and "gliadin." While Fleurent looks upon one part of glutenin to three of gliadin as being the normal for flour, Osborne and Voorhees give the following figures for spring and winter wheats respectively :—

	Glutenin.	Gliadin.
Spring Wheat Flour . . .	4.683	3.963
Winter Wheat Flour . . .	4.173	3.910

That is to say, in both varieties of wheat the glutenin is in excess of the gliadin. In some determinations made by Jago, and published in the *British Baker*, the gliadin was extracted direct from the flour by treatment with alcohol, and gave the following results :—

	Glutenin.	Gliadin.
Spring Wheat Patent . . .	5.23	4.81
Spring Wheat Bakers . . .	7.29	6.08
Winter Patent	3.69	3.63
Winter Bakers	5.12	4.43
English Wheat Patent . . .	3.07	3.33
Hungarian Patent . . .	4.79	5.37

Again, in both varieties of American flour the glutenin is the higher of the two, while in both English and Hungarian wheat flours it is a little the lower, but still a very high proportion of the whole. The gliadin is the tenacious or sticky part, like gum, that binds the flour; it is more susceptible to the action of moisture and soluble ferments, and more soluble in water than glutenin, which is insoluble in water and alcohol, also harder and more stable. The porosity and lightness of a loaf is due to the soft pasty and elastic gliadin. The latter is easily decomposed, like soluble albuminoids, and acts on the starch in a similar way. The substance mucin is very similar to gliadin, and is sometimes included in its percentage. The absence of this gliadin in its right proportion in flours possessing a large percentage of gluten, accounts for the otherwise unexplained differences in the behaviour and strength when percentages of gluten are the same. The artificial removing of part of this gliadin from a flour is found to considerably decrease the bulk of a loaf in the same way as too little of it naturally present in the flour would affect. On the other hand too much of it will often cause soft and sticky dough, the extremes either way being undesirable, and in new flours it is in a more soluble condition. Cases have been noticed where the flour was disappointing, according to its percentage of gluten, and was afterwards found short in gliadin; and where, on the other hand, gliadin was in excess, the dough rose well, and afterwards collapsed in the oven.

Mr David Chidlow, the well-known American authority, with whom the author has had the pleasure of comparing notes, found that the percentage of gliadin in gluten was in Winter American Patents about 80 per cent., and in Spring American Patents 70 per cent. In Spring Wheat Clears, or Bakers' Grades, as they are known here, the percentage was found to be 60 per cent., and in Winter Clears it was 60 to 70 per cent. He further found that in patent flour each part expanded twenty-one times its volume, in Bakers' Grades each part expanded sixteen times, and that two flours possessing the same percentage of gluten, but differently divided into glutenin and gliadin, the one containing a bigger percentage of the latter always making the larger loaf. It is therefore seen how necessary it is to have the right percentage of gliadin; and on this account there are certain processes that claim to convert glutenin into gliadin, and to adjust any excess of one or the other, whereby it is claimed that the gluten is increased to an equivalent of 20 per cent. When flours are blended together the respective glutens also blend. It is this difference in the percentages of glutenin and gliadin that accounts for the differences between low grade, or bran flours, that often contain larger percentages of gluten than other flours of better bread-making quality, and between the highest-priced flour in the world, namely Hungarian Patent, which does not contain a large percentage of gluten, but what there is of it is good.

Gluten, as seen by the differences above in wet and dry, is a large water absorber; nevertheless, there are some flours with high percentage of gluten that are poor water absorbers; and it is quite possible for a flour with 10 per cent. of dry gluten to produce a larger yield of bread, retaining more water, than one containing a higher percentage. Neither does excess of gluten increase the volume of the loaf in the same ratio, and when in excess, and not well matured, the loaf is frequently of bad shape, and also dry, but if there is too little the loaf will be small and flat. When the gluten is dried in the water-jacketted oven, as above described, it does not increase in size, but if heated at a high temperature, without being burned (it would often be in an ordinary baker's oven), when protected from too rash a heat, or, better still, when placed in a tube and boiled in oil, as is done in the aleurometer, it will then expand enormously to three or four times its original size. The relative expansions of the gluten under these conditions are carefully noted as a guide to its quality when tested in the laboratory. Although gluten is composed of carbon, hydrogen, oxygen, nitrogen, and sulphur, it has been found that, although there was no visible effect when exposing flour to the fumes of sulphur, that when attempting to wash out the gluten, the latter was a slimy and sticky mass, and had none of its proper characteristics, washing away with the water without any cohesion. The dough, moreover, made from a flour thus treated, was very sticky and difficult to handle, even when containing only 9 gallons of water to the sack, which is just half the quantity that is used in some parts of

Lancashire for tin bread. It is also practically impossible to wash out any gluten from a dough that has become ripe in the ordinary course of fermentation, although, up to a certain point, fermentation renders it more elastic and tenacious.

Speaking of fermentation, one is reminded that when gluten is acted on by alcohol, the glutenin is thrown down as a grey precipitate, but can be dissolved by acetic, tartaric, and dilute hydrochloric acid. The commercial value of gluten in flour must depend on the relative supply and demand of strong flour in the market for bread-making purposes, and on the purpose for which the flour is required to be used. Although gluten is desirable for bread-making, it is, on the contrary, injurious to the proper manufacture of several kinds of biscuits, and, if present, is required to be reduced in its effect by extra sugar. At the present moment gluten is more than usually valuable, strong wheats and strong flours being relatively scarcer than softer varieties—sometimes the contrary is the case.[1]

In conclusion, it should be mentioned that gluten is much in demand in the case of persons suffering from diabetes, because not only does it supply the body with nutriment, like lean meat and casein of milk, but is also more nutritious than starch, and starch is prohibited to such patients because of its being changed into sugar in the digestive system the same as it is by fermentation. Gluten bread, which, however, should contain no starch whatever, is usually made from dry gluten that has been ground into powder, then worked up sometimes with bran, ground almonds, or other flavourings, together with eggs. Much of this powdered gluten comes from the starch factories on the continent, but much gluten bread has been made by extracting the gluten from a piece of unfermented dough (putting the residue of starch into one's other batch), whereupon the gluten, as in the tests above, would expand by its own action, which it would not do when once it had been dried. Some people seem to maintain that diabetic food should not be entirely free from starch, and some so-called gluten bread that the author has seen from America has contained a considerable proportion of starch, merely a portion

[1] It has become so since.

of it being extracted by, apparently, punching the dough when under water. We append, however, an analysis of an excellent sample of gluten bread supplied by Messrs Bonthron & Co., of London, who are well-known specialists in this department.

GLUTEN BREAD.

Moisture	20.51
Flesh Formers	75·76
Fat	3·73
Sugar	None
Starch	Trace only

SALT

TO the chemist many salts are known, a salt being merely a substance composed of an acid and a base. Generally speaking, however, one uses the word to mean sodium chloride, or common salt, which is composed of twenty-four parts of sodium and thirty-six of chlorine, with traces of calcium and other insoluble matters.

Common salt is soluble in cold water, and not much more so in boiling water, but the boiling point is much higher in saturated solutions, being raised as much as 10 and 15 degs. It is insoluble in pure alcohol, and also an antidote to the latter. Bakers', or common, salt is produced largely in Cheshire, in Worcestershire, and in the United States, being obtained either from mines in the solid state or being evaporated from the water of brine springs. It will be remembered that not long ago considerable subsidence of foundations and also landslips occurred in Cheshire owing to the working of these mines. At one time also a considerable amount of salt was obtained by collecting salt from the sea ; and the author well remembers that one of the favourite walks of his schooldays was to some salterns, where the sea-water was let in at each tide and evaporated, leaving the salt behind. Evaporation being an important part of the process, the price of salt not only depends on its supply and demand, but also greatly on the price of fuel and on the cost of the iron pans, which salt wears out very quickly. Fuel being more in demand, and brine containing much more salt than sea-water, the extraction from the latter has now been discontinued, at any rate at the favourite haunt above mentioned. Salt, as referred to in detail elsewhere, has a considerable effect on the flavour of bread, also on the speed of fermentation. At one time it used to be described as the bridle of the steed yeast. It checks fermentation in proportion to the quantity added, having a binding and preserving effect on the flour. We know of a bag of yeast that was accidentally placed upon a bar of salt for some hours, and the bread made from it was considerably below the usual. In warm weather, or when sponges are long, it is often advantageous to put about a third of the total salt in the sponge, the remainder in the dough. In the long process, of quarter, sponge, and dough, in Scotland it is customary to add the salt in the three stages.

In England the almost universal amount is 3 lbs. to the sack (280 lbs.), which is normal in flavour; occasionally 2½ lbs. will be used, and if less, the bread will be insipid. With new or soft flour 3½ and often 4 lbs. is advisable, and this is the maximum usually ever heard of, but in Scotland a most usual amount is 6 lbs. Some in Scotland use as low as 4½ lbs. when using half sponge and distillers' yeast, and, exceptionally, we know of 9 lbs. to the sack, which is very excessive. Even 4½ lbs. can, according to other conditions, be usually distinctly tasted. In small bread a normal amount in England is ½ oz. to the quart (2½ lbs.) of liquor, but in Scotland the general amount is ½ oz. to the pound of liquor, which is 5 ozs. to the gallon, or 5 lbs. to the sack. See also the tabulated methods at end of book.

YEAST

YEAST, although sold and used in other forms, is to the twentieth-century baker most familiar when in a compressed pasty mass. This pasty mass is more wonderful than many understand, and is composed of a conglomeration of countless and practically identical, yet for the most part wholly botanically disconnected, globular discs, usually known as yeast cells. Each of these myriads of cells is an independent plant, the smallest in the world known to the botanist, about 4000 of them placed end on end being necessary to measure 1 inch. When separated from the others, each cell can grow, under normal conditions of proper food and temperature, rapidly in a characteristic manner and multiply itself extensively. Yeast propagates its species usually by budding, but also in exceptional cases, such as practically never occur during bread-making, by producing spores within itself, known technically as the process of endogenous division. The sugar cane is a good instance of a plant belonging to the endogenous division which grows within or increases by internal layers. Even at the comparatively high temperatures now adopted during bread-making the formation of spores would take more than a day, and the starvation of the cells would have to be excessive, therefore this method of growth, although interesting from many standpoints, can be dismissed from serious consideration as far as the baker is concerned.

In reference to budding, it will be noticed that if yeast cells, either singly, or in the mass as usual, be placed or sown in a suitable medium as, for instance, a little sugar and flour, and examined under a powerful microscope, on one or more sides a swelling will soon appear. This becoming larger, the cell breaks, and the new cell, or bud, for some time remains attached to the old cell before separating itself and growing independently. A commercial yeast that can be guaranteed as a pure species must thus be produced from a single or isolated cell, and according to a calculation by Pasteur, who watched two cells grow into eight in two hours, no less than

16,000,000 can be produced in a day. The medium, or liquor, in which the yeast thus grows will be found to have lost in weight, and to a larger extent than the increase in the weight of the yeast, showing that the yeast (all the fungi to which class yeast belongs do likewise, but to a less extent) decomposes or destroys more food than it requires for its sustenance. The solution, or wort, gets thinner, or attenuated, losing sweetness. In addition to loss in weight, heat, the monitor of all chemical changes, is produced, gases are evolved, many of the constituents are broken up into their respective elements, and the complex bodies are resolved into those of a more simple character. Without heat and suitable food these phenomena could not healthily occur, but the yeast would shrivel and finally die. Its vitality lasts for a long while, and, until actually starved, the yeast on being mixed with a warm sugar solution, or a malt wort, together with a little flour, and gently stirred occasionally, would be considerably revived into a normal and healthy condition.

Yeast, although possessing some of the characteristics of the animal kingdom, is now recognised universally as a plant. The globular cells consist mainly of an outer coat or envelope of cellulose, and an inner slimy liquid of protoplasm. The cellulose sac, although varying in thickness, according to the age of the yeast, is continuous. Having, therefore, no inlet or outlet, the yeast's food must be drawn through the interstices of the cellulose, and thereby be in a dissolved condition. It is hard, according to the popular idea of a plant, to realise that a piece of compressed yeast no larger than one's thumb nail should, by being composed of these countless cells, contain hundreds of perfect plants, all independent of one another. The cells of which the ordinary foliage plant is composed are, unlike yeast, merely inter-dependent, that is, when separated they are unable to live. They, however, are so related to one another as to secrete an important substance known as chlorophyll, the green colouring matter of plants. This substance under the influence of light and heat breaks down the carbonic acid gas contained in the air, and thereby obtains the carbon necessary for the plant's structure.

If a plant secretes no chlorophyll, it has no foliage, the foliage alone ever containing chlorophyll, thereby the plant would be of very simple construction. Thus we find yeast, although a plant, has no distinct root or shoot, the two being merged in one; neither does it, like the orchids that were recently kept healthy while on passage from abroad by being supplied with light from electric accumulators packed with them, require light for its nutrition. Yeast, therefore, having no development of root or of shoot, the root not being required by reason of there being no shoot to sustain, lives on organic substances such as sugars, starches, etc., actually in the process of decomposition, and absorbs their organic constituents before the latter are completely decomposed. It cannot feed directly on stable or cane sugar, or on sound starch, these substances having first to be inverted to glucose or grape sugar.

Of the two great classes of plants yeast belongs to the cryptogamia, which are flowerless, and do not possess the sexual organs known as anthers and ovules. This class has four subdivisions; the first, which is as far as we shall go, consists of thallophytes, which contain no leaves, having root and shoot merged, no vascular tissue, that is, pertaining to circulatory vessels, but only cells. These thallophytes, or simple plants, consist of (*a*) algæ or seaweeds, which contain that important substance chlorophyll; (*b*) lichens, which are formed by fungi weaving round seaweed; and (*c*) fungi, which contain no chlorophyll, and to which section our commercial yeast belongs. Fungi are divided, moreover, into five main groups; yeast, or saccharomyces, belongs to the ninth section of the ascomycetes group. Of saccharomyces there are only three really true species (1) cerevisiæ, consisting of two varieties, according to Hansen; (2) pastorianus, consisting of three varieties; and (3) ellipsoideus, consisting of two varieties. Other so-called saccharomyces, such as conglomeratus, glutinis, exiguus, mycoderma, albicans, etc., for reasons which we shall presently understand, are shown by Hansen to be misnamed. Under certain conditions of growth and temperature these species, in like manner as the top and bottom ferment varieties, can be made to resemble one another, but when again placed under the original conditions will revert to their original character.

A perfect yeast food should essentially contain a correct proportion of carbohydrate, preferably glucose ($C_6H_{12}O_6$) (prepared sugar) and maltose ($C_{12}H_{22}O_{11}$), also proteids (containing nitrogen), which, before they can nourish the yeast by percolating its cellulose, must be converted into a sub-group known as peptones ; also should contain phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), and sulphur (S), which all more or less can subsequently be extracted from the yeast ash. These constituents of food make up the chemical composition of the yeast in the approximate proportions of 47 per cent. carbon (C), 33 per cent. oxygen (O), 10 per cent. nitrogen (N), 6 per cent. hydrogen (H), and 3 per cent. ash. This ash, though small, by reason of containing many of the above-mentioned mineral substances, is very important. Phosphorus, potassium, and magnesium are herein combined with oxygen yielding fully 90 per cent. phosphoric acid (P_2O_5) and potash (K_2O), with about 6 per cent. magnesia (MgO) and about 1 or 2 per cent. lime (CaO). Yeast cannot assimilate free nitrogen or free carbon, but only when they are presented to it suitably combined with oxygen, whereupon they are decomposed or split up ; neither can it, as in the case of the chlorophyll-containing plants, obtain its carbon from the CO_2 of the air. To the same extent that its carbon for building up its structure is best derived from the sugars, so is its nitrogen, or stamina, best derived from peptones, it being unable to assimilate nitrogen in the form of nitrates. The peptones are the only class among proteids that are diffusible through the cellulose, and therefore available for the yeast's nutrition. Iron is not required for yeast growth ; moreover, the influence it has upon beer wort and boiling hops is not only superfluous but injurious. Some chemists say that beyond a trace [it exists in traces in some yeasts in the form of iron oxide (Fe_2O_3)] it is even poisonous. Thus for brewing operations and other long processes of fermentation scientists reject any water supply containing iron. As regards phosphates (yeast contains three or four times more of the potassium than of the magnesium phosphates), Salamon says a certain quantity of them is necessary for healthy yeast growth, but that an excess strongly retards fermentation, injures the yeast's vitality, and in every way does more harm than good.

Yeast cells, in addition to storing a certain amount of food in case of need, also secrete soluble ferments known as invertin and zymase, which, like the better known diastase, convert, when aided, starch into maltose and dextrine, and sugar into glucose, laevulose, and dextrose. The amount of zymase contained in yeast is very small, but sufficient for each cell if necessary to convert more sugar than required, thereby always assuring its sustenance as long as any carbohydrate remains. Besides producing maltose (sugar) and dextrine (gum) these soluble ferments, zymase and diastase, also convert the proteids into the necessary diffusible peptones; the dextrine is not directly assimilable, but is gradually converted or hydrolysed into maltose, thus providing of the latter in long fermentations a continuous supply. Below the temperature of 140 degs. F. the respective amounts of maltose and dextrine formed by inversion or hydrolysis remain constant, the amount of maltose being 81 per cent., and of dextrine, therefore, 19 per cent; above this temperature, until 180 degs. F., when hydrolysis ceases, dextrine increases its ratio, and affects the flavour accordingly.

In describing the various so-called varieties of yeast, it will be best to commence with the compressed. All bakers' yeast belong to the same family, as seen above, and differ from one another only in the same way as human beings, namely, according to their training and environment.

The compressed yeasts of commerce, unless specified to the contrary, are the products of distilleries. Some brewers compress their yeasts in the same manner, but these varieties are always known as "brewers' compressed." Although we have distilleries in our own country, there being 126 in Scotland alone, many of the popular brands of distillers' yeast reach us from France, Germany, and Holland. The yeast in question is, during the manufacture of spirits, produced from malt and raw grain. The raw grain, with due regard to variation in value, consists of barley, maize, rice, and rye. The latter cereal enters largely into the composition of the best varieties, and thus it was, owing to a European shortage of 28,000,000 of quarters of rye alone — more than three times the whole of the United Kingdom wheat crop—that these yeasts some little time ago advanced in price. This mixture of raw grain is mashed for about three hours, commencing at a temperature of about 130 degs. F., and gradually increasing to about 20 degs. hotter. At the end of this period the total amount of grain is increased by an addition of about 20 per cent. of malt. The mashing is continued until all the starch ($C_6H_{10}O_5$) contained in the grain is converted into maltose ($C_{12}H_{22}O_{11}$) or sugar. The progress of the change is ascertained by the adding of iodine, which stains starch blue and yeast light brown. As soon as the starch conversion is complete, the mash is cooled by means of refrigerators, and fermented by the addition of previously made yeast. The object of the fermentation now set up is, in the case of those factories that cater for bakers, to produce a healthy and strong yeast as much as alcohol. For this purpose the wort must be well and frequently ærated, since air, or rather its constituent oxygen, is most essential to vigorous yeast growth. When the fermentation is most active, the yeast is skimmed off the surface, conducted to sieves for the removal of the husks, and to drain therefrom into cisterns to settle. When settled, the surface liquid is drawn off, and the remaining yeast sediment is (occasionally mixed with starch), squeezed, drained, and pressed, and then put into the bags ready for delivery, such as we receive it.

There are, of course, variations in different distilleries in the same way as there are variations in bread-making in different bakeries. In some distilleries the preliminary stage known as the bub, corresponding, say, to a baker's ferment, is dispensed with, and the yeast grown like an offhand dough in one stage, it being in these cases contended that the yeast is thereby improved, particularly in keeping qualities. In this preliminary stage lactic acid is frequently placed and developed, so that an excess of it should check the growth of this souring ferment afterwards, it being well known that these foreign ferments cannot develop when surrounded by their own products, in the same way that yeast cannot ferment healthily when surrounded by an excess of alcohol. Other dilute acids, such as sulphuric, have similar effect. The presence of oxygen or air is of the greatest importance, and thus in many distilleries this is pumped in at the bottom of the vat. Concerning this point, Pasteur says :—"To multiply in a fermentable medium, quite out of contact with oxygen, the cells of yeasts must be extremely young, full of life and health, and still under the influence of the vital activity which they owe to the free oxygen which has served to form them, and which they have perhaps stored up for a time. When older, they reproduce themselves with much difficulty when deprived of air, and gradually become more languid; and if they do multiply, it is in strange and monstrous forms." Although aeration by pouring from tub to tub, and also by fermenting in shallow vessels, has always been recognised in this respect, the pumping in of air was not so essential when the alcohol or spirit was of more importance than the yeast.

Yeast was at one time considered only as a bye-product, and not turned to the same commercial account as now to replace the home-made yeasts of bakers; but now there is an enormous accumulation of spirit in bond, and the distilleries seem to keep working to get the yeast as much as anything, making it now almost a primary product. The injection of this oxygen into the vat, which gives the appearance of boiling, with practically nothing else but a little extra nitrogenous matter, has enormously increased the production of yeast, and the same can be done on a smaller scale with air in home yeast-brewing. Whereas in the ordinary way every pound of yeast sown would increase itself commercially to about five times, it is now found to increase to fully twenty times. In the same way special varieties of yeasts for bakers' use will probably be in the near future receiving more prominence, with special reference to their products and action. Low yeast is slower in its action than high yeast, and not so suitable for bakers. The great advantage of distillery yeast as sent to market is its accurate and scientific preparation, giving, in a concentrated form, a great amount of actual yeast in a healthy and matured condition, whereby it will work very quickly, and turn out

Section of Square (or Sandwich) Tin Loaf.
(ACTUAL SIZE.)

bread in the shortest possible time. Not only will it enable this speed to be attained, such as cannot be so well provided by other commercial yeasts, but also it will generally produce better results if this quick-working tendency be encouraged. That is, although it will make good bread in small quantities over a long period like other yeasts, it will make better, especially as required for the English trade, in larger quantities worked warmer over a short period.

The vigour of yeast per pound not only depends on its origin and condition, but also on whether or not it contains such added matters as starch. It has been contended that quantities of starch, say up to ten per cent., are not a fraudulent adulteration, that they are added for the purpose of making the yeast keep better, that they do not interfere with the amount of yeast cells or power in a given pound, because they merely take the place of water. This is ingenious, and it may be said that even water in a glass is to some extent like a pile of marbles, that is with vacant spaces between its molecules, but there are compressed yeasts that are starch free, and can be easily discovered by testing, and these are those which should be purchased. If the yeast is dry and in good condition, as some are without starch, it is in itself evidence of careful manufacture and delivery. If it is admitted to contain a little starch, the little has a knack of getting large occasionally, and being not only dear at even sixpence per pound, but also dangerous to stock, because an ounce sold over the counter renders the seller, although he sells it as received, liable to prosecution and costs. It is strange how so many people, when purchasing compressed yeast, always ask for German, whereas the best-known brands are mostly Dutch, French and Scotch, and it would be as well to remember that a highly respectable firm was recently prosecuted and fined for selling, in good faith, a class of china, known in the trade as Dresden, taking its name in the same way according to the place in which it was originally made, but which in this case had not come from that place. The law, as Bumble said, may be "a hass," but it is likewise very stubborn. The yeasts that originally came from Germany were not so well grown for the baker's purpose, or so well washed, and were altogether less vigorous than those of to-day.

Brewers' yeast, although occasionally receiving extra attention and being sold occasionally in a compressed state, is as a rule, when sold in the liquid state or as "thick," unworthy of reliance for modern bread-making as compared with its modern rivals. One unsatisfactory circumstance is that in all liquid yeast one cannot so easily gauge how much actual yeast the liquid contains, or its state of health and maturity. Some people attempt to get over this by using even the liquid by the pound rather than by the measure, because froth is sometimes awkward to gauge. The real reason for brewers' yeast, although once so largely used, having deteriorated, is the comparatively little attention or consideration given to it, the chief object of the brewer being to produce beer, which he does by using less malt and more substitutes than formerly, and yeast, to be strong, can have nothing better than malt. Where yeast from the brewery is urgently needed, the brewer can give better quality than much of what he would consider was all he cared to sell in the ordinary way, namely, he could give some of that which he uses to start his own fermentations, or also some of that which oozes out of the bung-holes of the barrels when fermentation is being allowed to complete before finally corking. One rather curious feature about English brewers' yeast is, that before the laws were quite recently altered in Belgium, a large quantity was exported there as being the best obtainable. Ale yeast is better than stout in vigour and colour, and the darkness of brewery yeast is due to impurities and other matters sold with it.

The bitterness caused by the hops can be minimised by the baker, by adding bran, well stirring with extra water, allowing yeast to settle and pouring away the top liquor. The yeast can also be treated with borax or other alkaline substances for the same purpose. The borax, although having considerable effect on soluble ferments, has very little on yeast. The bitterness would not, of course, be so much noticed in longer processes with smaller quantities of yeast as in short. Brewers' yeast, although occasionally, when compressed, possible in offhand doughs, should, as a rule, at least have a ferment, and also often a sponge as well as a dough. It wants much more nursing than distillers' yeast, and is not nearly so safe in warm weather although slower working, and even when made with plenty of malt is not worth the trouble and risk in spite of alleged flavour, when the distillery brands can be obtained, which, however, is not possible with some of our correspondents.

There are many ways of making patent yeasts, which term should include all variations of flour-barm processes and home-made malt and hop yeasts, and has quite lost, like so-called patent or best flour, any connection with the Patent Office. The one thing, in addition to the trouble, appliances and experience required for these yeasts, that made them unpopular and rendered them less and less employed was their irregularity and weakness, and this was due to the insufficient use of malt. This ingredient is, of course, somewhat expensive when good, but to stint it, as was often done, is very false economy. Too little malt and too much water was what crippled these yeasts, in the same way as substitutes for malt in beer-brewing spoilt brewers' yeast for bread-making purposes. Now that distillers' yeast, owing to the large accumulations of whisky, is becoming scarcer, and therefore dearer, there is, in remote parts, some inquiry for home-made yeast, and the growing of distillers' yeast in the bakehouse by means of malt, and this has particularly been the case from several correspondents in Africa, Australia and elsewhere. The following process has been given to private correspondents, and has received their expressed approval: Take ½ lb. of best hops, boil in copper vessel or stew-pan (avoid any rust on iron pot) for ten minutes (not simmer for a long time, as sometimes done). When thus boiled, empty hops, with their boiling water, into a tub, making liquor up to 9 gallons at 150 degs. F. When at this heat stir in 8½ lbs. to 9 lbs. crushed malt. Malt must not be boiled with the hops, as is sometimes done. Instead of getting extra strength out of it by this means, the malt is weakened and some of its effect destroyed, as its albuminoids are coagulated like the white of an egg, which is the same substance, when at 180 degs. F. Having added malt, let whole stand covered up for one and a half to two hours. Then strain into shallow tub, well squeeze malt grains that remain in strainer, and well wash and rinse them with another gallon of water, making whole wort up to 10 gallons.

If regularity is desired, the density of this wort must be tested, and should always be the same; but if by variation in the malt, or in the completeness of its mashing, it should be weaker or stronger, that is, of lower or greater density (as shown by the hydrometer, which can be bought at most instrument makers, or at some chemists and opticians), then the quantity that is to be used subsequently must be varied. The best density is 30 higher than water, and, as water on most instruments is put at 1000, the density of the wort should be 1030, or about the same as good, pure milk, which varies between 1027 and 1032. One secret of good, reliable patent yeast is just there, and sufficient malt must be added to get it. There is more substance in some malt, weight for weight, than in others, and all operators do not get the same out of it; therefore the result should be judged by density, all other points, of course, being equal. When all strained and in shallow tub, allow to cool to 75 degs. F. or 80 degs. F. It is essential that this cooling should be done rapidly, and refrigerators are therefore used in big bakeries. Add ¼ lb. of salt and 1 quart of yeast from previous brewing. Stand this in a room from 65 degs. F. to 70 degs. F. Stir occasionally, or, better still, pour from one tub into another, so as to get air into it for reasons as explained above, and it will be ready for commencing bread-making stages in twenty-four to thirty hours.

Purity and strength of the quart of yeast added and the purity of surrounding air and the tubs are, of course, important circumstances, but plenty of malt, plenty of pure air, and a steady and cool temperature have great effect. Take 5 pints, or 6 pints, of this yeast to each sack (280 lbs.) of flour for the ordinary bread-making process, which, of course, with this yeast, is longer than with distillers' yeast, owing to the latter being used in larger quantities. Brew at least twice a week. In hot countries the following guiding lines must have more emphasis: Malt strengthens, hops are antiseptic and check disease ferments, salt preserves, and coolness of the setting temperature keeps well in hand. Brew as frequently as possible, and do not use it beyond the fourth or fifth day after brewing in any case. One pound of malt to the gallon is all the better, although unusual, and even 1½ lbs. is not wasted or really extravagant as some would seem to think. It must not, however, be thought that malt is anything but a food, and the presence of food does no good unless properly used, and does not, as some seem to think, take the place of any of the yeast, unless more reproduction be allowed. Another good antiseptic is hydrofluoric acid, which checks undesirable ferments or organisms, but only very slightly affects yeast.

Respecting the quality of yeast the safest test for the baker is to dissolve one's yeast, in the case of the compressed sorts, in exactly the same accurate way each day, whereby almost unconsciously a reliable test is afforded by which anything wrong can at once be detected. If one does not wish to trouble to make a separate ferment by way of a test, there is almost always a small batch of some fancy-bread or buns to be made. The ferment for that should always be made with the same quality and quantity of flour, the same amount and heat of water, the same amount of sugar, etc., and put in the same bowl and position, etc., or a part of it dipped out and put in a graduated jar. By this means the height to which it rose, the rapidity of the rise and fall, could and should be carefully noted, together with the result in batches in the bakery register that ought to be regularly kept. This is most simple and the trouble not noticeable when once well established. In laboratories, the power of the yeast is usually calculated by the amount of the gas evolved. A small quantity of yeast, such as ¼ oz., is set away in a bottle with sugar or other special yeast food, kept at a regular temperature by special means, and then the gas collected in specially arranged jars, and the whole more accurately done than the baker, especially during a night's heavy order, could or would do. There are several details, and in all these small tests of any sort, the author has experienced that it is no good to write down or even explain methods without standing over the learner and seeing him do the work, when absolutely reliable results are desired.

The author has kept one of these ¼ ozs. of yeast going for three weeks entirely on sugar, adding more sugar and shaking up as soon as the gas diminished, whereupon activity was at once renewed, but the time came when the yeast would no longer convert the sugar into gas until the water was changed. Many such experiments afford much information and practice with the microscope, with which interesting differences in the yeast in various conditions and stages can be noted. But here, again, a little knowledge is most dangerous concerning commercial value of yeast, and the author well remembers that just about twenty years ago he was doing a good deal of this microscopical work, and thought he knew nearly all about it, but has been learning ever since. It is customary to refer to distillers' yeast as being composed of oval cells and brewers' of round, but it is impossible to tell the variety of yeast entirely by shape as some kinds vary according to age and amount of fermentation, and many samples have different characteristics under similar treatment. Before testing in a ferment as described above, or by 1 oz. yeast to half its weight of sugar, and four times its weight of flour in forty times its weight of water, much information can be obtained, in the case of compressed yeast as most often used, by examining in the dry state.

When opening bag, the yeast must not be warm or sticky, should not smell like cheese but have a pleasant, fruity or apple smell, and leave no acid twang when tasting; should break in the fingers with a clean fracture and with a kind of click, not being on the one hand soft or clammy, and on the other too dry or crumbly. The colour, in the case of distillers', should be creamy white, and in brewers' is darker. It should be kept in a cool, dry place, and in warm weather it would be as well to tear off the bags on arrival and press yeast tightly into a stone jar, where it should keep well for a week. We are frequently asked if it could be exported to such places as Tasmania where the journey is six weeks, but although cases of exporting to Madeira have come under the writer's notice as successful, it has been only at expensive rates in quick liners, and used principally in the expensive hotels; and although cases of keeping a month on the liners are not uncommon, such distant places as Australia can better make their own yeast. The same may be said of Africa, where transport and distribution are yet excessively expensive.

The desiccated or specially dried yeast, or yeast mixed with starch into yeast cakes as sold comparatively largely in America, is, in the writer's experience, very feeble: it takes a lot of growing before getting much activity for commercial batches. Desiccated yeast extract shows practically no falling off of fermentative activity after being kept for twelve months in a stoppered bottle. The addition of 1 per cent. of sodium chloride (common salt) or ammonium chloride to yeast extract only slightly diminishes its activity, but with 2 per cent. the effect is considerable; 1 per cent. of sodium, ammonium, or magnesium sulphate or 1 per cent. of sodium nitrate produces the same effect as 2 per cent. of sodium or magnesium chloride. The presence of 2 per cent. of calcium chloride totally prevents fermentation, although the same amount of barium chloride is almost without influence. Borax has a slightly less effect than common salt. The largest and most active portion of the yeast-extract is separated at a low pressure and is opalescent; further pressure separates a more transparent and less active liquid. The extract contains appreciable quantities of silicic acid, has no marked rotatory power, and can be filtered through a sandstone filter without losing its power of fermenting sugar. The filtrate from a fermenting sugar solution was found to contain no zymase, but a small quantity of invertin, showing that the former acts only within the yeast cell, but the latter partly outside it. The hydrolysis of sugar by invertin is a reversible change, and the enzyme has a slight synthetical action on invert-sugar.

When compressed yeast is kept in a warm and moist place, or when it gets bruised or damaged, it is apt to start fermenting of its own accord, without being dissolved in the ordinary way in warm water and added food. This action is usually known as softening or autofermentation and liquefaction, and, as one of the terms implies, is a feeding on itself. In the same way as wheat when sprouting or feeding on itself, by exposure to too much warm moisture in the fields after cutting, affects the quality of the flour, so does the softening of yeast affect its strength and sometimes produce a bitterness. Unless, however, a bad odour is emitted, slight damage can often be compensated by increased quantity. The time required for the liquefaction of pressed yeast is greatly diminished by rise of temperature, whilst the rate of evolution of carbon dioxide is greatly increased. The evolution of gas ceases as soon as the yeast becomes liquid and hence is small at 50 degs. (122 degs. F.), owing to the rapid liquefaction of the mass (one to one and a half hours), whilst the total volumes evolved at 39 degs. (102 degs. F.) and 26 degs. (79 degs. F.) do not differ greatly, although the times required for liquefaction are, according to some experiments by Messrs Harden and Rowland, five and fifty-three hours respectively. At 14 degs. (57 degs. F.) the time required is sixteen days, the rate of evolution being extremely slow, and the total volume evolved about 75 per cent. of that produced at 26 degs. Alcohol is produced simultaneously, the process being apparently a true alcoholic fermentation of the glycogen of the cell. Microscopic examination shows that as the evolution of gas proceeds the glycogen disappears and the vacuole of the cell increases in size. Finally, the vacuolar contents are discharged and the cell appears shrunken and irregular in outline, whilst the protoplasmic contents are highly granular. In the presence of oxygen, a process of oxidation accompanies the evolution of carbon dioxide, a considerable rise of temperature being produced and the total volume of carbon dioxide increased. When exposed to a continuous current of oxygen, a sample of yeast was found to lose 26 per cent. of its carbon.

When yeast is dissolved and used in the ordinary way in commercial bread-making, the best range of temperature is from 75 to 95 degs. F., and could be preferably put into a smaller compass by saying 80 to 85 degs. The range of life could be put from 50 to 140 degs., but during bread-making there would be practically no action at 10 degs. higher than the minimum, and 10 degs. lower than the maximum would be as bad or worse. The effect of the temperature depends on the duration of exposure to it. Such extremes of cold and heat on the one hand paralyze, and on the other hand kill. It is, however, possible to revive yeast by gradual warming and coaxing after it has touched freezing-point for a short time, and cases have been known of gradual and dry heating up to 200 degs. for short time with subsequent action. Yeast will not stand being completely frozen for purposes of transit like frozen meat, and when using extra hot liquor for dough-making it is best to reduce the heat by first adding some flour before the yeast.

The quantity of yeast to be used per sack of 280 lbs. flour must depend on the time and heat to be allowed for the bakehouse operations, and the strength, character and condition of the yeast as above indicated. This will also apply to the quantities of one class of yeast that should be substituted for another, but it can often be taken that 1 lb. of distillers' compressed will equal 3 or 4 pints of liquid brewers' and 12 pints of patent or home-made. Inasmuch as a really pure and distinct culture can only be guaranteed if produced from a single cell, and a pound of yeast is only a reproduction of that single cell by a matter of time, in the same way that the present millions of people in the world have sprung from Adam and Eve, a sack of flour can therefore be aerated by any quantity. In fact it can be aerated by yeast without adding any in the ordinary way, because there is always some falling from the air, as is well known in certain so-called spontaneous processes of bread-making as will presently be considered under the heading of barm, and also amongst the colonial methods, as tabulated in Section VII. In actual practice we have found good loaves produced by adding from 4 ozs. up to 5 lbs. per sack, and as dealt with under flavour they will no more taste of yeast in the latter than the former. Whatever may be said about yeast not being able to reproduce itself in a stiff sponge or dough, it is a practical fact that the less added the longer must be the time allowed for maturity. We once summed up the position by saying 12 ozs. of distillers' yeast to the sack would make a good loaf, half the amount could, but double was better for daily work and treble for exhibition or small batches.

In batches of much less size, it will usually be found that the proportion per sack must be nearly doubled, because there is less comfort as regards heat retaining and also usually more surface, in proportion, for allowing gas to escape. Although we have always found the above relative proportions safe, which however must as explained vary according to conditions, we have just thought of consulting the opinions of others, and see Gribbin says the usual quantity per sack is a quart of liquid brewers' with ferment, sponge and dough, and also possible with sponge and dough, and that this would equal 1 lb. of distillers', also that 1 lb. of compressed brewers' per sack would be about right. Kirkland says 6 ozs. distillers' will equal 8 ozs. brewers' compressed, depending on when added, and that the flavour can be obtained by adding the malt without the hops. Vine says 1 pint of patent to the bushel in a potato ferment. The whole question, however, must be settled according to individual circumstances and requirements. If it were otherwise the writer would not have, with traders throughout the empire, such an enormous and increasing correspondence, which, even with most complete and systematic classification and with increasing amount of assistance, is at times very exacting, every reply being of the fullest and most exhaustive character.

Virgin barm and Parisian barm, of all the popular Scotch ones, are the two leading types. The only difference between these two is that Virgin barm is set without yeast or barm (this is the typical and old custom, but now very often it is stored with old barm), therefore is allowed to start fermenting entirely of its own accord, whereas Parisian is stored or started with barm left over from a previous brewing.

For the former take 10 lbs. malt, mash it ninety minutes in 3 gallons (30 lbs.) water at 160 degs. F.; infuse 3 ozs. hops for a little time with 1 gallon boiling water, then strain both these infusions. Wash the draining malt grains with another gallon water just under boiling. Mix in 40 lbs. flour; scald this mixture with 7 gallons boiling water, adding it in instalments of two, three, and two, and stirring sharply between each. Leave this tub of barm uncovered for twenty hours, then well ærate by turning it out into another tub, when at an average temperature for the year of about 80 degs. F. add 3 ozs. salt, 10 ozs. sugar, and little flour; stir occasionally. It is best used on fourth or fifth day after brewing, and should be stirred every twelve or twenty-four hours while thus slowly fermenting. For Parisian, instead of adding the above salt and sugar, add 1 to 1½ gallons, according to time of year, of old barm about two days after brewing, and when the temperature of the barm is 80 degs. as above. Active fermentation will be over in rather less than a day; tub should then be moved to a cooler place and not used until after barm has dropped some time. The "spontaneous" Virgin barm, owing to the surrounding conditions considerably affecting the time at which the process would start and the rate at which it would ferment when started, has lost favour. The Virgin barm is now either stored with old barm instead of being allowed to wait until starting spontaneously, and thus may be said to resemble Parisian barm, or else the Parisian as described by us above is employed. Some bakers have discarded malt and hops in their barms, and use flour and sugar solely; about two-thirds of the flour would be scalded and the other third raw.

Many other details, which will be found in the list of Scotch methods of bread-making given near the end of this book, have been furnished in various letters from our Scotch correspondents in the ordinary course of consultation. In his early days the author confined himself to a personal acquaintance with merely the English methods, and when first proceeding to closely study the highly interesting and instructive Scotch methods, he was much indebted to conversation and correspondence with Mr W. A. Thoms, of Alyth, who at that time was able to take an active interest in such matters. The Edinburgh lectures of some ten years ago, and those of Mr A. Kirkland, of Irvine, have also been a valuable contribution to this branch of the subject, which, although chiefly of local importance concerning details, is also, as referred to in the chapter on methods of fermentation, of considerably wider importance with respect to the underlying principles involved. Mr John Kirkland, who hails from Scotland, but is now a very near residential neighbour and acquaintance of the writer's, does Scotland an honour by the way in which he discharges his duties as head teacher at the National School of Bakery, and in referring to the subject of Parisian barm, says: The essential thing about it is, that it consists of scalded flour, mixed with a strong decoction of malt. It is not usual to use any hops. For a small quantity 2 lbs. of malt may be mashed with 2 quarts of water at 165-170 degs. F., and this allowed to stand for about three hours. The liquor is then thoroughly squeezed from the grains into a small tub, and about 8 lbs. comparatively soft flour made into a thick, tough batter with this liquor. The water for scalding (about 2 gallons) is then kept boiling, and is poured on to this batter, 2 quarts at a time, a man standing by with a long pole and vigorously stirring all the time the water is being poured on. This liquor is then kept in an open tub till the following day, when it will have thinned very much, owing to the diastasic action of the malt on the burst starch of the flour. When the liquor is cooled down to about 80 degs., it is stored or stocked with about a quart of barm from a previous day's making. In about twenty hours from time of storing this barm will be ready for use. It is generally used for making half or quarter sponges, but it will serve equally well to make straight dough. About ½ a gallon of this barm may be used to make a quarter or half sponge to stand twelve or thirteen hours. If a quarter sponge, then it has to be made into a batter sponge in the morning with all the remainder of the water required to make dough, except about a gallon required to rinse out the tub. This batter sponge will stand from one to one and a half hours, until it is just about to turn, when it is tipped into the trough or machine, and made into dough. If a half sponge had been made, this batter sponge stage would be left out. Those two methods of making and using Parisian barm are the common methods followed in Scotland. "Parisian" barm is not now much used anywhere else.

If the so-called compound barm is desired, one should boil 10 pints (Scotch) of water and add 2 ozs. of hops; cover up and allow the liquor to cool down to 170 degs. Now throw in from 12 ozs., for summer, to 1 lb. for winter, of malt to each pint of water. Stir all round thoroughly, and cover up once more for four to six hours, so that it may mash. Now pass the whole over the strainer, so as to take out the malt, and let it cool down to storing heat, namely, 86 degs. in winter, or about 80 degs. in summer. Put in ½ a pint of old barm and 4 ozs. salt, mixing all well together; cover up and let it work. It will soon be all covered over with little bells of a greenish colour, and make a hissing noise; but it will be quite clear and placid in about twenty-four hours after storing, when it is ready for use. When dropping last time it is a healthy sign when covered with clear bells, when in good mature condition the small, clear bells should be only round sides and not in the centre. If going too fast add another time less store or have lower heat. In cold weather it is better to increase the barm rather than the heat very much.

A good range of temperature for barms in different seasons is 75 to 90 degs. F., and they should be made three times a week or not be more than three days old, having taken about two days to get ready.

SELF-RAISING FLOUR

ALTHOUGH good flour has a certain amount of natural expansion when mixed with nothing but water and baked, it is said to be "self-raising" when mixed with certain acids and carbonates in such a way as to react on one another, producing gas in sufficient quantity to render any goods, properly made therefrom, well raised and light.

The acids and carbonates, or chemicals, added to the goods should neutralise one another, or be in such proportion as to neutralise other acids, already in the goods, as, for instance, sour milk, so as to leave no residue injurious to health or flavour. Most of them have action on one another, disengaging gas immediately water is added, but not before; it is therefore necessary to keep them, when mixed before using, in a dry place, and mix them with good dry flour. If kept in a concentrated form, so as to be added in varying amounts to different classes of goods as required, it is best to mix with a little dry rice flour or ground rice, or other dry or dried starch. Owing to this immediate action on adding moisture, the gas evolved must not be allowed long enough to escape while the goods are being made, because, although it is the same gas as evolved by yeast, no more can be produced without adding fresh chemicals, not being produced naturally and gradually as by fermentation.

Some chemicals as, for instance, tartaric acid, give off gas not only in larger quantities but also much quicker than others as, for instance, cream of tartar. Others, such as bicarbonate of ammonia, commonly called volatile or vol, give off their gas only by the action of heat, that is, when in the oven and not when being mixed with the milk or water. Some goods such, for instance, as so-called "soda scones," or soda cakes, can be raised by the addition of a carbonate or base without any added acid, the gas being produced by the action of bicarbonate of soda on the acid of the buttermilk or sour milk. In such cases oftentimes, however, there is not enough acid to neutralise all the soda, and when the latter is in excess there is a strong and unpleasant flavour, which would be counteracted by a little cream of tartar. There is also often an unpleasant smell and flavour when volatile is used, which, however, has the advantage of being able to raise goods without other additions, leaves no solid residue, and is cheaper than many ærators. Volatile is handy for very small goods, and also for putting into flour for supplying to housewives, because by doing its work only when in the oven, its power cannot be lost by careless handling during the making of the goods, and also makes them break open in the centre with a nice-looking cauliflower top. Although cream of tartar is the most expensive of the acids generally used, there is nothing more satisfactory, in conjunction with half its weight of bicarbonate of soda, for the generality of purposes. If cheaper ærating agents, or any of the numerous substitutes are used, it is also best to have a portion of this mixture as a base to save accidents. There are different prices for different degrees of refinement in cream of tartar in a similar way as there are for flour, and its purity can be easily tested by adding, say, half a teaspoonful to a glass of boiling water, whereupon there should be no cloudiness. An ounce of bicarbonate of soda is supposed to give off about 10 pints of gas, and magnesia, although more aperient, is not so strong. Tartaric acid is really about three to four times as strong as cream of tartar, but by its working more gas would usually be lost, and in practice it would be safer to take it as only twice as powerful. It is often added for cheapness, and although, like volatile, handy for breaking open some goods, it will be too powerful and quick in many instances, and should only be used in small proportions.

It is no economy, when making for one's own use, to stint the quantity or quality of the chemicals, or weaken or cheapen, as done in some cases when supplying to housewives, by adding 1 or 2 lbs. of salt per sack, or other substances, but it is best to make rather strong, so as to serve for the various goods required. Small things want more than large, and scones more than cakes. The quantities of chemicals added vary largely. One recipe of 8 lbs. of cream of tartar, and 4 lbs. of bicarbonate of soda to the sack of 280 lbs. of flour would, within personal experience, be found successful; another would be 6 lbs. of cream to 3 lbs. of soda for same flour; another would be 2½ lbs. of cream, ½ lb. of tartaric, and 2 lbs. of soda to same quantity of flour; another would be 4 ozs. of cream, 2 ozs. of soda to 8 lbs. of flour; another might be 15 lbs. of flour, 4 ozs. of sodium carbonate, 2 ozs. of cream of tartar, 2 ozs. of tartaric acid; another be 14 lbs. of flour, 1 oz. of tartaric acid, 1 oz. of cream of tartar, ½ an oz. of volatile (ammonium), 2 ozs. of sodium carbonate, with or without about 2 ozs. of fine starch. The chemicals must, of course, be powdered and sifted before adding to flour, or else the whole be sifted together afterwards. When mixed, they should be kept air-tight, and for own use should be prepared about once a week. Another suitable recipe would be 36 lbs. of flour (if a soft or damp flour, 4 lbs. of ground rice could be added with advantage; there is, however, of course, no useful gluten in rice, therefore less strength than in flour), 1½ lbs. of cream of tartar, ¾ of a lb. of carbonate of soda.

When these and other ærating agents are sold in a small and concentrated compass, for the purpose of mixing with the flour afterwards when about to be used, they are called baking powders, and as such are referred to below under the heading of alum.

ALUM AND BAKING POWDERS

THE use of this substance in bread is now so seldom heard of that it might have been left out of consideration, except that one does occasionally hear of one or two cases per annum amongst the many thousands of bakers. Also that there are certain baking powders and self-raising flours that contain it, and also some substances that appear to do so, by reason of giving a similar chemical reaction to the well-known one characteristic of alum. The determination of alum in flour or bread is at all times a very difficult and delicate operation, so delicate in fact that certain cases are recorded where the county analyst had certified the flour to contain alum, but the manufacturer, well knowing that he had added none, demanded an independent analysis, and the government authorities certified the substance as perfectly pure, and he was accordingly acquitted. It is now practically never found in flour as supplied by the miller, because the latter would get no advantage from it whatever, and the need of it by reason of its properties, which we shall explain, is now past so far as the baker of bread is concerned. It is now illegal to add it to flour, bread, or baking powder, although until recently the latter was exempted as not being an article of food, according to the Act.

Alum is a compound of alumina, potash, and sulphuric acid, being thereby a strong astringent; its effect during fermentation is to toughen the gluten, retard its decomposition, and check rapid inverting of the starch. It is this astringency that is objected to by some doctors, because in the same way as it hinders decomposition of the flour during fermentation so does it retard the digestion in the body, and have other effects, such as constipation. This effect in fermentation was very useful in the days when we were confined to

A PRIZE ENGLISH CRUMBY LOAF

(PHOTOGRAPHED TO SHEW TWO SIDES).

the wheat from our own country in bad and wet seasons, because it prevented too much change taking place in already badly conditioned flour, which change would have caused a dark and close loaf. It was undoubtedly a great help when using sprouted wheat, which had to be used when there was nothing else, but with smaller crops, and improved methods, there is less damaged wheat than formerly, and, moreover, owing to importation there is less need to use even what there is.

With badly conditioned flour, alum has the effect then of making the loaf hold more water, and also producing it whiter and bolder. The recognised method for its detection in flour is to take 5 grams of freshly cut chips of logwood and shake up with 100 c.c. methylated spirit, then mix 10 grams of flour with the same weight of water and 1 c.c. of recently made tincture of logwood and 1 c.c. of concentrated solution of ammonium carbonate. Pure flour will have a slight pinkish tint fading to dirty brown, afterwards lavender or dark blue, and if dried in oven the blue colour remains constant. With bread one can take 5 c.c. of tincture of logwood and 5 c.c. ammonium carbonate dilute to 100 c.c., immediately pour it over 10 grams of bread, stand five minutes and drain; if pure the bread has a light red tint, then buff or light brown, the colours being the more intense of course the larger the quantity of alum, and also being accentuated when dry.

It has sometimes been found that bread gave the reaction and coloration characteristic of alum although the flour from which it was made gave no such reaction, the reaction being due to the sourness of the bread, and the presence of phosphate of alumina that exists in combination with gluten, and is soluble by acetic acid. Flour naturally contains this alumina, but the reaction with logwood is very slight, unless the alumina be dissolved by acetic acid being added. In the case of bread, especially when sour by prolonged fermentation, acetic acid will be produced by fermentation, and the reaction characteristic of adulteration by alum can sometimes be found when fermentation has thus been allowed to proceed to sourness, whereas it cannot be found in a piece of the same dough tested when fermentation commenced.

Baking powders also give the blue colour characteristic of the addition of alum when there is none present. A solution of tartaric acid gives it, although tartaric acid the same as cream of tartar and sodic bicarbonate give no coloration in the dry state. This blue colour characteristic of alum is produced by iron, lead, copper, and zinc, and there is strong evidence that when the coloration characteristic of alum is given with baking powders that contain none, that it is due to the small quantities of lead and iron that are present in the ingredients used to produce baking powder, and of course in the same way with self-raising flour. Small quantities and traces give purple, and larger quantities give the blue. At Nottingham there was a conviction for adding 10 grains to the pound, and the reaction in bread has been known to be given by natural causes, and not by fraudulent adulteration, to the extent of representing about 650 grains to the sack. It will therefore be seen how intricate the whole subject is, and how, particularly in this respect, a "little knowledge is a dangerous thing," and also how curious are the changes that time brings about, whereby alum, which was formerly known as "ground hard," is now practically never used in bread, but has given place to a substance almost precisely opposite in its chief effect, namely, Malt Extract, as composed in most cases.

HOPS, LIME AND OTHER ANTISEPTICS

AN antiseptic is any substance that preserves from, or resists changes leading to, putrefaction or decay. There are several antiseptics of interest to the baker, amongst them being the common salt or sodium chloride ($NaCl$), salicylic acid, the tannin contained in hops, and borax. Salt and alum have been fully treated under distinctive headings. Borax is a compound of boracic acid (B_2O_3) (a compound of boron and oxygen) and soda; boric acid (H_3BO_3) (boracic acid crystals containing $H_2B_2O_4 + 2H_2O$, made by adding sulphuric acid (H_2SO_4) to a hot concentrated solution of borax). Borax is not soluble in water, but boracic acid is slightly, and turns blue litmus paper red, and yellow turmeric paper brown. Hops are always used, chiefly because of this presence of tannin, and tannin is used occasionally in white wines when showing signs of viscous or ropy disease. A solution of tannin can kill in two hours some bacteria that can live ten days in a solution of strychnine that would kill a man.

These antiseptics, like ordinary salt, slightly retard the action of yeast as well as that of the disease germs, although the action on the latter is immensely greater. After a recent inquiry conducted by a Government Departmental Committee, it was recommended that salicylic acid be permitted only to the extent of 1 grain (there are 480 grains to an oz. and 5760 grains to a lb.) in a pint of liquid or 1 grain in a pound of solid food. Also that the only preservative which it shall be lawful to use in cream be boric acid, or mixtures of boric acid and borax, and in amount not exceeding 0.25 per cent. expressed as boric acid. The amount of such preservative to be notified by a label on the vessel. Also recommended that the only preservative permitted to be used in butter and margarine be boric acid, or mixtures of boric acid and borax, to be used in proportions not exceeding 0.5 per cent. expressed as boric acid. Also recommended that in the case of all dietetic preparations intended for the use of invalids or infants, chemical preservatives of all kinds be prohibited. Another admitted fact is that 5 to 10 grains per day is as much as an adult should take of boric acid. It was recently demonstrated that 5-grain doses of boric acid taken every four hours was sending a man to his coffin.

Well now, it is well known that boric acid, being more tasteless than salt, is frequently put into milk in hot weather, and there was recently a case where a man was fined for putting an excess into his water-cress; and we know the exact quantity that a certain large firm of cake makers put into their cakes, saying, that they have found that amount the best thing possible for preventing ropy cake, and we know of many other goods in which it is used. Therefore, when so small a quantity per day is the only safe amount, and it does not take very many pinches of the fingers to make up an oz., where people do not understand what they are doing, is it not then a very dangerous tool that might cut both ways? If recommended therefore here, as some have suggested it to us, without studying the matter or without expert advice on all the circumstances, would it not stand some chance of bringing disrepute on the baking trade, the same as the arsenic in the impure acid, that made the glucose for the brewers, brought on the brewing trade when an overdose poisoned Liverpool? The brewing trade is strong, and strongly represented everywhere, and it is not so fashionable for it to be attacked in the papers even when it does do wrong, as it is for bakers to be attacked for adding things such as alum and borax that many in the trade have never seen. The antidote of small pox is cow pox or vaccination; as to whether it is wise to wilfully submit oneself to a mild form of disease in order to minimise the chance of catching a worse one, is a point on which there is much controversy. The writer has had very little effect from vaccination, but some people not only get very bad arms but seem quite upset and invalided in themselves. The moral of the above is obvious. Borates hold a large quantity of water of crystallisation, and therefore swell up when heated; it is largely to this effect that cockroaches are killed by borax, which soon diminishes them. Owing to the recent prohibition of adding boric acid to foods in some districts on the continent, many experiments have been made, and it was found that, although about half of the quantity taken was expelled from the body within about twelve hours, the remainder disappeared but slowly, traces being found in the urine up to eight days afterwards, and that it retarded digestion, similar to alum, and was liable to set up irritation in the intestines.

Lime may be mentioned as an antiseptic in more than one form. It will preserve eggs by stopping the pores of the shell. Bisulphite of lime is a good solution to sprinkle on the troughs; it can be swished with a brush well into the corners, and has no ill-effect; it does not require removing afterwards; it is not like plastering with slaked lime, it is a thin liquid, and is further considered under the heading of troughs. Carbonate of lime was at one time used in bread in some parts of Scotland, and we have had personal experience with it in other districts. It was the foundation of a special process of bread-making that was not long ago pushed somewhat extensively and favourably received, particularly in Scotland, the land of the inventor. We were reminded of this the other day by turning over some pages of a trade journal and seeing an inquiry concerning carbonate of lime, and the reply was that the substance was not known for bread-making use, and that probably carbonate of soda was meant. It is astringent like alum, and has a similar effect as regards checking diastasis, or changes produced by certain malt extracts, but it is not in usual quantities injurious to health like alum. It is found beneficial with soft and unsound flours, and for minimising some of the effects and tendencies of flour made from the sprouted or growy wheats of a wet season, or newly ground flour from sticky wheats. It must be interesting to note that, although of the opposite character to the more usual kind of malt extracts sold, it, by being astringent, makes the soft flour hold more water, thereby increasing yield of bread. It is used in bread in the form of clear lime water, the same as that which turns milky when breathed into, or mixed with the impurities of the air, as discussed under ventilation. It can be purchased at any chemist's or made on a commercial scale as follows:—

If wanting liquor for five or six sacks of flour, have a tank containing about 50 or 60 gallons of pure clean water. Into this put 1 lb. of recently burned quicklime, and stir thoroughly. The water, according to the proportion it already naturally contains, will only hold in suspension about 9 or 10 ozs. per 50 gallons, and when, in an hour or two, the remainder has settled to the bottom, the clear water on top may be run off by a tap or by a syphon tube, which should not be low enough to disturb the sediment. Not more than 7 gallons per sack—that is, about half the total liquor required per sack—of the lime water thus made should be used. The above is the best way of preparing this lime water where the convenience exists, because by such means one will get in the bread no excess, nor any undissolved lumps or impurities, as all such would sink to the bottom of the tank. A careful man could, however, for every sack of bread required, take the same proportion of lime as given above (maximum, 1½ ozs. per sack), dissolve in a bucketful of water, and empty it all into the trough, except any residue that settled immediately after stirring up. It would, however, be much safer and better to put 2 ozs. into 10 gallons of water, and draw off 7 gallons of it for the sack (6 bushels) of bread. The lime unites with the gas of the air or the gas of the yeast, and results in chalk or calcium carbonate ($CaCO_3$), which, however, in these quantities is not injurious. All water contains small quantities of this chalk or calcium carbonate, and its presence makes water what is known as "temporarily hard." This temporary hardness is destroyed by boiling, since that we find our boilers and kettles furred by a deposit of this carbonate, which the boiling has precipitated. The lime water prepared as above must not then be boiled. It has just occurred to us that, some few years ago, a friend of ours spoilt a batch by adding lime. He overheard the writer casually refer to it, and straightway, without further thought, commenced its use. The failure consisted in the fact that he had added a great excess, stirred it up, and used all, instead of decanting merely the clear liquid without sediment; but even this could have been no worse than the plaster of Paris which, according to the papers, has recently been added to French flour.

There are also many other antiseptics, of which, merely, a few need here be mentioned. Hydrofluoric acid, (and the fluorines) in small quantities arrests the action of lactic and other foreign germs, but, like hops, only slightly retards the yeast or alcoholic fermentation. It is used largely by brewers, and could also be added when making patent or home-made yeast. Alcohol is an antiseptic, and so is vinegar. Carbolic acid is a strong and familiar antiseptic, but its fumes are not nice in a bakery, and are liable to be absorbed by such ready absorbers as flour and bread. We had almost forgotten to mention that salicylic acid is often used in fruit juices and jams to retard any undesirable fermentation starting, and that 2 ozs. dissolved in alcohol are usually added to 25 gallons of juice, or 40 grains to the gallon; its effect on the human system is injuriously depressive. Other powerful germ destroyers are, essential oil of bitter almonds, mint, eucalyptus, turpentine, and camphor, varying in strength in the order named, even the camphor killing more than half of the organisms in contact, and the first being particularly strong. The best thing to keep flies and wasps away from goods, instead of muslin covers, is to have a few drops of some eucalyptus oil, the same as recommended for influenza, on a piece of wool in a dish, or else a spray of essence of lavender.

SECTION II

THE GOOD AND FAULTY POINTS OF A LOAF

"Not sowing hedgerow texts and passing by,
Nor dealing goodly counsel from a height
That makes the lowest hate it, but a voice
Of comfort and an open hand of help."

TENNYSON'S *Aylmer's Field.*

FLAVOUR

FLAVOUR can be defined as the quality of a substance which pleasantly affects the taste or smell. In speaking, however, of the flavour of a loaf of bread, one must consider something more than mere taste, such as can be conveyed by a condiment. One can hardly consider flavour, apart from the freshness and moistness, and the "pleasantness" and relish experienced during eating, and the ease with which it is masticated, or conduces to digestion. Further, when receiving bread at various times from almost all parts of the world, one has considerable difficulty in judging the flavour, because of the various characteristics that are liked or disliked according to the district.

Taking two extreme types, namely, the long quarter sponge system of Scotland, and the short off-hand doughs that are now becoming so popular. A Scotchman frequently says, and undoubtedly believes, that there is no bread in the world so sweet, as that made from his, excessively long, process by Parisian Barm, but when making such a statement he cannot possibly have tasted bread from such a process as the four hours' system. Consumers, however, who are accustomed to the short process never fail to at once say, that the long process loaf, which a Scotchman calls sweet, is undoubtedly sour. It is quite obvious that with the long process, there must be some acid produced, and very much more than in a short one ; acid cannot possibly be sweet and will be liked or disliked according to the taste acquired for it, a person who has become accustomed to acids not liking similar foods without. Local customs and individual tastes, even of different people in the same district, are such important factors that one often feels it would be safer when judging a loaf of bread to entirely ignore the flavour, yet the difficulty is that flavour is unquestionably a most important element of a loaf, and as essential as the wheels to a coach.

In order to taste the flavour of dough it is necessary for it to be baked, but much information can be acquired concerning the flavour of flour before being made into dough. The aroma of flour is volatile and can to some extent be criticised when the latter is in its natural state. When heated, by even holding in the hand, the aroma or smell evaporates very much more quickly, giving more indication of what it would be when baked. Still more information can be obtained by taking a series of flours, some with which one has already been acquainted in the baked loaf, placing them in cups or glasses, pouring on them hot water, stirring and smelling immediately. Any oldness or characteristic will thus be immediately and rapidly given off, and conveyed to the senses, and can be accurately gauged by means of the known samples.

When examining a loaf much information concerning flavour can be ascertained by observing the physical signs denoting changes or added ingredients such as discussed elsewhere. Much information can also be obtained by the smell even without tasting, but it is always safest in a critical test, although not possible when judging several hundreds of loaves at the exhibitions, to eat two or three pieces in order to neutralize any conflicting flavours that there might be in the mouth. Then proceed to carefully chew a piece, moving it about with the tongue and getting it on to the palate, noting carefully the readiness with which it breaks up in the

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mouth, and the series of sensations that will be experienced during gradual swallowing; and carefully note the final taste as the piece is disappearing, and the after taste. Anyone noting the different sensations, thinking them out while eating, will, if unaccustomed to doing so, be surprised at the variations that are experienced, which will be unnoticed when eating in the ordinary way without closely studying. The differences in the sweetness and in the effort of chewing, and of the roughness or smoothness, the tendency for the mass to divide itself, or cling into a ball, rankness or otherwise will be found to be very great; and after a little practice one will be able to accurately judge a large number of loaves almost by instinct, and without the same close application.

The differences and peculiarities of the individual tastes of persons are undoubtedly the sheet anchor of a family business, and the salvation of the small trader in close contact with his customer, as against the wholesale trader who must have more uniformity and neutrality for a large number of customers with whom he is not in contact, the intermediate party, the grocer, usually buying by the eye and not by the palate. The flavour of bread must depend on the degree of fermentation, on the quality of the flour, on the condition of the latter, and whether or no it has become contaminated accidentally, and on the amount and character of added substances. As a rule the conditions that tend to produce a high percentage of gluten during the growing of the wheat act against flavour. The conditions, however, that tend to a high percentage of gluten usually result in a better maturity of the flour, and the more matured the flour is, the less its flavour will deteriorate on keeping.

The best flavoured flour, all other things equal, is the one that is freshest milled. Flour becomes stale and loses its flavour quicker than those who have not looked into the subject would credit. We recently tested this matter more by accident than by anything else, having before thoroughly done so personally, by two parcels of the same brand of flour that had arrived at an interval of about nine months. We gave out portions of them for domestic purposes, merely asking for the two to be used separately, and for any characteristics to be noted. They were exactly the same make of flour, but we were told that one worked much drier, took more water to mix it, and that the children, who had no intimation that they were being experimented upon, immediately expressed their dislike to the flavour of some of the goods made. The older sample, which was nearly twelve months old, was more pronounced in flavour than the one nine months younger, although both were sound, and had been properly kept. If distinctly noticeable as nasty at twelve months, it must have lost its fresh aroma long before. It is not everyone who has a critical palate, and some flours keep better than others, and well that it is so, when sometimes flour used must be about twelve months old, especially when it has been a long time—perhaps all the winter—coming, and then rests for good periods in granary and bakery over here.

The way to see the important effect of fermentation on flavour is to compare a loaf raised naturally by the gas produced by yeast with the loaf that is raised by gas, which is prepared outside and then pumped in, as in some systems, or with a loaf that is raised by adding chemicals. The extent of the fermentation, rather than its rapidity, will be the ruling factor in the various differences that there will be between these two extremes. The presence of acid and change, as developed during fermentation, will strike the palate, and give the sensation known as flavour, in proportion as it is concealed or otherwise by other substances. For instance, salt not only has effect on flavour by steadying fermentation, but has a flavour of its own, which, according to the amount added, makes itself apparent, or hides, or counteracts other effects. If added in normal quantities, which in the South of England would be about 3 lbs. per sack, it is not tasted; if added in much smaller quantities the bread would be insipid, unless some other flavour, such as acid, had been developed; if added in quantities of 5 or 6 lbs. per sack, as customary in Scotland, the loaf will have a distinctly salt taste, unless, on the other hand, it should be largely covered by an excess of acid often produced by long processes. In exactly the same way it is possible to add commercial vinegar, or acetic acid, in certain small proportions that it cannot be tasted. Although not tasted, its presence must counteract some of the natural sweetnesses of the flour, which otherwise would convey, by means of the palate, the sensation known as good flavour.

Much importance is placed by some people on the kind of yeast used, but on the same principle as the salt and vinegar, the yeast is not added in sufficient quantity to give a direct flavour of its own. In fact, any flavour is chiefly due to the amount of fermentation that the yeast is allowed, by time or heat, to produce. When the system of straight doughs first came into vogue with large quantities of yeast, it was frequently remarked by those who were counselled to use it that such large quantities of yeast would taste, and it was frequently futile for the author to point out the fallacy of such a statement. The indisputable proof to the contrary, however, is given by the fact that bread is frequently made for special purposes with even 5 lbs. of yeast to the sack, and has no yeasty taste whatever when properly managed, in fact, not nearly so much of this so-called yeasty taste as in the case of very much less yeast under other conditions, as, for instance, with a small quantity worked a long time. If another proof were wanting, it is only necessary to calculate how much the customary 1 oz. or 2 ozs. of yeast to a quart of liquor when making small batches of buns, or fancy bread, would be to the sack, noting the absence of the taste of yeast.

The difference between the different so-called sorts of yeast as used in commerce, such as brewers', patent, and distillers', is chiefly their degree of concentration, and the condition of fermentation necessary to suit them. In the case of brewers', however, there is usually present a very strong decoction of hops and other matters, which are quite distinct from the yeast itself, and which are sufficiently strong to make themselves noticeable. A similar bitter taste to that obtained from brewers' yeast, that has not been well washed or purified, is sometimes noticed in the case of continental, or other compressed or dried yeasts, when they have deteriorated during keeping, or undergone a partial decomposition known as softening. Some people are so wedded to the idea of brewers' yeast making good-flavoured bread, that they cannot conceive anything to the contrary; it would, however, be just as reasonable to suppose that good meat never decomposes, or good fruit never becomes rotten. Speaking of fruit reminds one that the degree of flavour in bread is just as varying in its appreciation as different sorts of fruit, many of which require an acquired taste before being valued, and personally this has been particularly so with other foods, such as tomatoes. The addition of milk, sugar, lard, malt extract, glucose, and kindred substances, must, like salt and other ingredients mentioned, affect according to their proportion, and the stage of fermentation at which they are added. Some of them are directly fermentable by yeast, and if added at early stages are consumed before the loaf is baked.

The flavour of a loaf can sometimes be judged by physical signs that tell the amount of fermentation and the degree of change in the flour, but it is not always so. We have had loaves to examine that have been the picture of health, evidently made from the best flour, in the best possible manner as regards its degree of change, but the flavour was distinctly bad and surprising. It was afterwards discovered that the ferment or prior stage, in which practically no flour had been placed, had been allowed to stand a very long time under bad conditions. It had thereby developed bad flavours which, like an excess of vinegar, were not afterwards hidden when added to the main batch. If the bad flavours or sourness developed in the prior stages, such as in the above ferment, be not in excess, they can oftentimes afterwards be counteracted so as not to be noticed in the loaf. A good instance of this is in the case of leaven bread, as made on the continent. The piece of leaven, which leaveneth the whole lump, is left over from the previous day's baking, and is absolutely sour; this is mixed by gradual stages with the fresh flour, which, being in such large proportions to the original leaven, hides the sourness and makes good palatable bread. The same thing is seen in this country when a sponge has been over-ripe, and is largely counteracted by the sweetness of the flour which is used for the dough stage. Any sourness, moreover, would be very much less noticed if the dough were made larger than originally intended, that is, if the dough were, as it is called, stretched, because the original order of bread required was subsequently increased. In the same way where one's circumstances make one suppose that a long sponge is necessary, it is best to have this sponge as small as possible if one wants good-flavoured bread.

Under the heading of crust, dryness, and baking we have referred at length to the varying effects of a quick oven. Shorter baking in a good heat will have considerable effect on the flavour, especially in driving off the stale gases, products or sourness that would have been present in the dough, according to its treatment. The degree of baking will have very much more effect on the loaf than the fuel with which the oven is heated. There is, however, a prejudice in favour of wood, especially when burned on the sole of the oven, as in several country districts, particularly in Germany and other parts of the continent. Nevertheless, although wood is as cheap as ever, and coal and coke during the last few years have been dearer, one finds from personally traversing the country, that wood-fired ovens are giving place to externally heated ones, especially of the steam-pipe kind. A loaf of bread, like flour, is particularly absorbent of flavours or aromas with which it comes into contact, but while in the oven, as has already been shown, moisture, alcohol, and gases are being driven off, it is therefore difficult to see how a loaf can absorb anything at the same time as it is exuding. Nevertheless, there was recently a case in France where poisoning of certain people, by the bread, was traced to the fact that the oven had been heated with old and painted wood obtained from some demolished houses, and, further, there is now an edict to prohibit, for ovens, the use of such painted wood, or anything that can possibly be contaminated.

Whatever may be said to the contrary, and we are fully aware of what has been said on this subject, there is undoubtedly a considerable difference in the flavour of different flours, not only according to the characteristics of the wheats, but also according to the way in which they have been milled. If an analysis be made of the moisture that has evaporated during milling, as might happen when the wheats had not been in a good condition or had sweated, there will be found therein phosphates and various volatile oils of characteristic flavours. The Hungarians claim that by carrying the intermediate products of milling by hand instead of by a greater use of elevators, as is general in this country, that they thus preserve some of these volatile oils. In the old stone mills, undoubtedly, heating the germ by friction during milling produced an aroma that permeated the whole flour. We can now get a similar effect in the same way by taking separated germ, heating it and passing its fumes through flour that was not milled at the same time.

As an instance of the characteristic sweetness and nice flavour of a freshly ground flour, from a nice selection of wheat, in this country, as against those from harsher wheats, or those taking months to arrive, it may be mentioned that it has come under our personal observation that mice are great discriminators in this respect. We know a case where they consistently always elected to eat into a certain grade of flour in a baker's loft. They never touched anything else when that grade was there, and they always attacked it sooner after its arrival than they did any other. The same mill, which was noted for its specialité in flavour, also supplied another grade similar to it, but not so choice or special in flavour. When the two arrived together, the first-named was always attacked first; when that was out of stock, but not before, the mice attacked the other grade from same mill, and afterwards the others. They so persistently attacked these two flours, and especially the first, in preference to all other grades in loft, that the baker frequently refused to order large quantities, unless he was going to use them rapidly, solely on this account. Absolute fact.

The absorbing character of flour has already been referred to, and we have had many cases of tainted flour come under our notice. We know of a cargo of Vienna flour that was rejected because it was contaminated by the smell of oranges. We knew of other flour that had a most objectionable smell, and baffled all attempts at finding out what it was for a long time. It afterwards transpired that the flour had been made from wheat that had been shipped in a vessel that some years before had carried Guano manure. Unless one could personally vouch for such instances, they would seem incredible. We know of cases where in a consignment by railway of only a few tons of flour, all milled together, and all railed in the same truck, some of the consignment was considered unusable by one customer out of several who had flour out of the same consignment, whereas no one else noticed anything unusual. This had been caused by the flour being covered by a newly dressed tarpaulin, and the few bags on the top that the sheet touched absorbed the smell. We know of cases of paraffin contamination through flour being put in a truck that some time before carried the oil. It was not the contact of the oil, but merely the smell arising from the dry floor of the truck and permeating the sack. New sacks will often convey a smell, and are, therefore, often filled with wheat offals before being filled with flour. But the curious thing is, perhaps, that such contamination, like a plague of red ants in bakeries, disappears almost as rapidly as it comes. Where it is only a dry contamination, such as from the mere effluvia of the dressed sheet or the dry floor, there is no need to worry or to destroy the goods, and they are worth keeping at a small discount. The smell soon disappears, and, in proof of this, we have known many cases of such rejected flour being used by another man without the package being changed, or anything whatsoever done to the consignment, and without the slightest indication that anything had even been wrong, even in cases where the new recipient had been told that the flour had been found tainted and rejected by others.

Flour that, in underground places, has come in contact with the worst of water has been all right inside, if shot from the sack before becoming musty. We know of shipwrecked cargoes of Vienna and other flour that have returned handsome profits to the buyers because others were afraid of the supposed excessive damage. For the first week or two that sacks of flour stand in water it seems that the soakage into the sacks is to the extent of about one inch per week. If the wheat has got thoroughly wet, causing the interior to become unsound, the damage is, of course, permanent, but not so if merely the outside, or the bran, has become wet. In modern mills wheat is frequently passed through water or "washed" for purposes of cleaning, and also occasionally damped for purposes of easier milling. If the sacks of flour have been packed in a truck on wet straw, or the latter

Section of Crumby Loaf.

(ACTUAL SIZE.)

has afterwards got wet, any smell or dampness from the straw will quickly evaporate if suitably stored, and, particularly, during baking. Many instances of this have been afforded by the fact, that where one baker has complained of a strawy smell, the flour has been removed to another, and found to be thoroughly desirable. Bad flavours often evaporate in exactly the same way as the good flavours of fresh-milled flours do during storage.

THE WAY POINTS HAVE USUALLY BEEN ALLOCATED AT EXHIBITIONS.

	English, Welsh, and Irish.		Scotch.
	Formerly.	Recently.	
Flavour	20	25	15
Colour (2) Of Crust .	20	25	10
Colour (1) Of Crumb .	20		5
Texture	20	25	10
Volume	20	25	10
Maximum	100	100	50

COLOUR

ALTHOUGH colour is so much discussed in connection with bread, few who place so much importance upon it stop to inquire as to what colour really is. It should be defined as property inherent in light (or the condition in which it is transmitted), which gives to bodies different appearances to the eye, that is, it is merely a sensation, caused by the rays of light. Colour then is a sensation carried by means of the eye to the brain rather than anything actual, and varies according to the conditions under which it is transmitted. For instance, the same thing has a different appearance to different people which is well-known in the case of colour blindness, and also according to the surroundings, as in the case of flour on blue or white paper, and also according to the amount or character of the light, such as is the case between daylight and artificial light.

The finer the flour is dressed or ground, the more the globules are open to the light, and the more complete the refraction, conveying to the brain by means of the eye purer or whiter light. This gives what we call better colour, although, of course, in reality white is the absence of colour or no colour at all. In the same way two loaves of bread from the same dough, and baked side by side, and therefore substantially the same, will sometimes be considered of different colour, one looking whiter than the other. The one, as will often be noticed in a tin loaf as compared with a crumby loaf, by proving more has become more porous than the other, whereby the more porous one by absorbing more of the rays of light appears to be the darker. On the other hand, a more silky loaf sometimes appears to be of better colour than it really is, according to the position in which it is held during examination. The colour of a flour depends on the percentage of its constituents. The whiteness is the result of starch, which is the largest portion of the flour, and depends on the degree of refinement and removal of dirt. Although whiteness is often spoken of as good colour, and good colour commands high price, there can be an excess of starch, dead white flour being of worse value for bread-making purposes than a flour possessing a yellow cast. The whiteness can be obtained by adding a highly refined starch from some other cereal, such as corn-flour, and can be obtained for less money.

Flour made from good red wheat would be better than that made from a common white. If flour be too highly refined it will be approaching too near to pure starch, thereby losing the bulk-giving and moisture-retaining characteristic of gluten, and the bloom characteristic of sugar. The presence of yellow indicates the presence of good class gluten freed from the coarser portions. The patents of the flour will be yellow, but the lower grade, although sometimes containing a higher percentage of gluten, would be browner, because of coming from nearer the bran and containing more impurities. The middle skin of wheat contains most of the colouring matter of the bran, but the inner layer contains some of the brown that is ground up in low grade flours. The germ of wheat, which in modern flours is practically absent, is yellow, and it or its oil would, of course, have some effect where present. The whitest flour is usually from the centre of the berry, and white can usually be taken to represent flour either from strong wheat highly refined and not so much strength left in it, or else flour from a soft wheat poor in gluten. Yellow represents quality, and brown would represent strength of lower character, while grey would be poor.

The changes in colour of flour would be most during the first fortnight after milling, after that the change would be very slow. It is the yellow that would evaporate quickest, becoming bleached in proportion as it was exposed to light and air. These various tints can be seen when the flour is in a dry and natural state, but when pressed on a board and dipped in water the differences are very much more acute. Various changes occur during drying, and the flours can be best compared when they have been allowed to become again thoroughly dry by natural evaporation. When some flours are thus pressed and wetted up together, much information concerning their general commercial value can be obtained. Considerable experience, however, is necessary in order to gauge the value that can be placed on the various tints, according to their behaviour during bread-making; here, very particularly, it will be seen that the whitest flour is not always the best bread maker. The safest way is always to test the flour concerning which one wants to get information at the same time as other leading types with which one might be acquainted. Types vary considerably from year to year, and therefore any attempt to standardise them is often very misleading.

It is very popularly supposed that fermentation always increases the colour of the bread, but fermentation can darken as well as bleach. In the case of the Scotch process, which is usually conducted with a considerable amount of care for a very long period, bleaching or whiteness is particularly noticeable. In the case, however, of long periods of fermentation with less precautions, not only is the yellow destroyed, but a dullness and darkness is produced, just as in the case when a dough from a strong or low grade flour is immature. A piece of dough during the process of being made into loaves will often become darker on the exterior if not covered up, and then will be seen in the form of streaks when turned inside in the process of moulding. The effect of time and fermentation on colour, both of crumb and crust, can be settled beyond dispute by making a dough, cutting off pieces at each hour over a long range of time, for baking and noting separately.

The colour of bread is also affected by the ingredients that are added. Brewers' yeast with its attendant impurities, and potatoes with their dirt will darken, while scalded flour will whiten. Occasionally there are quite foreign colours found in bread, such, for instance, as red spots (known as bleeding bread), which are attributed to a very small organism with a very long name. They may be due to an insect or mould on the grain which is too small to be removed during milling, and the small amount of colour present in the dry state spreads considerably on being wetted. This coloration does not seem likely to be due to anything that has got in during bread-making. We have occasionally found violet patches in the dough which have been less noticeable when in the loaf; we have found this repeatedly to be present when the wheat contained garlic, and although this is no direct evidence of garlic being the cause, or of the cause being different to the case of the red spots mentioned above, it seems to be more usually present when garlic is than otherwise. On one occasion a greenish-blue spot was noticed in the crumb, and after considerable difficulty it was found to be caused by a piece of coloured string, the dye of which had spread.

The condition of the gluten seems to have considerable effect on the colour and character of the crust, because an excess of sugar does not give that same foxy or red crust that comes from a cold or checked fermentation. The gluten changes from a brown to a paler tint, according to the time that it is fermented. If good flour be fermented quickly with a comfortable heat, the crust will be of a nice brightness; and if the flour be poor or overworked, the crust will be slaty and dull. When, a short time ago, maize was so cheap that considerable portions of corn-flour were said, in the land of its production, to be added to wheaten flour, it was noticed that it was more difficult to obtain a good crust colour, and also there was a distinct shortness in the eating. The intensity of the colour of the crust, all things being equal, should be in proportion to the time it is exposed to the heat of the oven; sometimes, however, in the case of a cottage loaf, the part that first pulls away from the bottom which should, in the ordinary course, be most coloured, is not so. When this portion where the top parts from the bottom is variegated or unevenly browned, the circumstance can almost always be taken as a sign of irregular fermentation or too much change. Sometimes there is seen to be a red ring round the crust; this is due to the loaf being left on the boards when topped, and allowed to get dry on the surface. Therefore when the loaf is raised, on being put into the oven, the top pulls from the bottom, exposing to the heat the surface that is moist through being in contact with the bottom; the damp surface taking on more colour than the dry, the acute division of the two leaves a line all round, or a ring. A high crust colour is obtained in some Scotch places by throwing salt on the furnace, and also, sometimes, by putting on wood when dry enough not to smoke; intense colour thus obtained shows up the colour of the crumb to advantage by contrast. High colour is also, sometimes, obtained by washing the loaf with water or grease when coming out of the oven as well as when it was being placed therein.

The bloom, or colour which a loaf takes on the crust during baking, will be affected by the quality, character, and grade of the flour, by any other ingredients that might be added, by the amount of fermentation, by the condition of the surface of the pieces of dough, when being set into the oven, and by the amount and character of the heat to which they are exposed. Highly dressed flour would, all things being equal, have a higher percentage of starch than a coarser flour, and as such have less in it that would attract the heat or bloom. In the same way the addition of sugar or malt extract would facilitate more colour than a pure flour, while the addition of fat would have a contrary effect. A good instance of fat repelling the heat of the oven is seen when hot-cross buns are crossed, as they are in some parts of the country, by a strip of paste containing butter or lard ; of course the paste has exactly the same heat as the bun underneath it, yet the bun will take very much greater bloom than the strip of paste.

Fermentation has considerable effect on bloom ; if the dough be in any way under-ripe there will be an excess of colour of a reddish hue, which, however, is almost distinct from what is known as bloom, and is usually called foxy, which is a blemish, whereas the term bloom applies to a desirable colour. The loaf that is over-ripe, on the other hand, will take less bloom, and in the case of a sour loaf the bloom is entirely absent. It is almost impossible in the latter case to get any brown coloration whatever, and certainly no bloom, which should really be defined as a bright and light brown or healthy-looking colour.

The condition of the surface of the piece of dough when being set into the oven is of primary importance in the case of bloom as, if the surface be really dry or skinny, there will be no bloom, no matter from what ingredients the dough has been made, or to what extent it has been fermented, or to what extent it is afterwards to be baked. It is almost as difficult for a dry surface to take bloom as it would be in the case of a sour loaf, no matter how intense the heat of the oven might be, but, of course, the hotter the oven under other conditions the greater would be the bloom. It is on this account that the pieces of dough while proving on the boards should be kept covered, whereby no skin would be allowed to form, or the surface become dry. The pieces can be covered up with a thin sack or flannelette, either dry or wet, but preferably the latter. Objection is sometimes made that the cloths after some little use begin to smell, but this need not be so ; they should be dipped in water, and well wrung out, because if they are too wet they cannot be left on the loaves sufficiently long without sticking, and we have seen pieces of sacking sticking to loaves in the prize case at the Agricultural Hall. The cloths will keep in good condition if frequently washed and then dried quickly, and damped again when being required for use, and they will keep wholesome until worn out or fit only for making scuffles for cleaning the oven.

A good bloom, and also a gloss, will be obtained by proving a loaf in steam, and also by injecting steam into the oven whereby the moist surfaces are kept moist; also the smoother the crust is moulded the better will be the bloom, all other things being equal, and likewise the greener and moister, that is, without too much cones, the better condition will the surface be in for the purpose of taking bloom. Of course it is harder to mould a loaf with a smooth surface with a slack than with a tight dough, and bloom is therefore here, as throughout all the other details, resolved into a question of skill, and there should be very little excuse for the large amount of bread with sickly crust and without bloom at the exhibitions. The washing over of loaves even with water, to say nothing of milk, egg, or scalded flour wash, is a very poor substitute for the proper method of getting bloom, and can certainly be called faking, that is, making a loaf appear what it is not. A loaf in good health and properly cared for needs no washing for the purpose of a proper bloom. Much bread is baked in too cool an oven.

The large majority of high-priced flours, in the straining after what is called good colour, in order to appeal in the dry state to the buyer's eye, have a marked tendency when doughed against taking a healthy crust bloom in the baked loaf, most of the bloom-making qualities being removed during milling. There are, however, individual flours, well known to the author, that are specially made to combine bloom, flavour, and moisture with general quality, and which give a better colour in both crust and crumb than the unwetted sample would indicate.

TEXTURE AND PILE

TEXTURE can be defined as being the disposition or connection of interwoven threads or fibres. In a loaf of bread texture seems to be usually associated in one's mind with holes, but the presence or absence of holes does not constitute the whole difference between good and bad texture. A loaf having a hole can be of a better texture than one without, and a loaf without holes, as, for instance, a badly made and then over-proved tin one, can be coarse and crumbly, and therefore of bad texture. At the present moment the writer is facing a pair of lace curtains, exceptionally well and finely woven and of soft feel, therefore of excellent texture, but at some future time they will, unfortunately, have rents or holes made in them at the laundry; they will obviously be still good textured curtains, and still better textured than some other cheaper and coarser ones, although possibly in good repair, in another room. If a thin slice of bread be cut and held up to the window, whereby the light goes through it as through a curtain, the texture can be seen perfectly, and far more pronounced than in any other way. Any unevenness or streaks, or hard, or close layers, or cores, which are blemishes in texture, will obscure the light and show up like the closer portions or pattern of the curtain.

Although the absence of holes does not constitute a good textured loaf, nevertheless, a good textured loaf would be all the better when entirely free from the larger hollow places or cavities known as holes, and when discussing the latter at considerable length under their own heading, many of the principles governing the present subject will be found detailed, and should be consulted, holes really being the absence or the breaking down of texture. When judging at the last Annual Bakers' Exhibition at the Agricultural Hall, London, "texture," was allocated a maximum of twenty-five marks out of one hundred, the other three quarters being equally divided between flavour, colour, and volume, as against formerly twenty out of one hundred. This large proportion of marks clearly indicates the im-

PRIZE IRISH BATCH OR CRUMBY LOAF

(Photographed to shew two sides).

portance of texture, and the guide or index that it is to the whole process of manufacture, holes being merely taken as a section of it.

A loaf to be of good texture, must not only be of fine and regular mesh, but also of soft, pliable, and springy crumb, that is, not coarse to look at, nor hard or unyielding to the thumb when pressed, nor yielding too much, or more in some places than others, without quickly recovering the indentation. These characteristics, the same as pile, as elsewhere described, are not so much of such vast importance *per se* as they are the physical signs of the state and history of the loaf. A similar case is where the purity of the atmosphere of a room is gauged by the amount of carbonic acid gas present, not because of any poisonous action of the latter by itself, but because (except, as should be noted, in bakeries where it is otherwise produced), it is usually present in strict proportion to other deleterious products of combustion or exhalations from the lungs.

The above desirable characteristics are indicative of and to be obtained by (1) proper system of fermentation with good materials; (2) well made and well cleared dough; (3) thoroughly ærated dough, well changed, but taken with some spring in it; and (4) good and firm handing up, then suitable moulding, then enough proof to allow the closed-up interstices to re-expand or recover, but not enough to allow them to get opened again too much, or thus producing coarseness. The dough must not ramp along at any period, must not be left too long to itself, whereby the gluten becomes broken down too much, or the threads or web too weakened. It must have gentle labour at frequent intervals, according to the speed of fermentation, whereby the gluten is preserved and well stretched and folded over until its threads are fine and the vesiculation even, and able to hold, without breaking anywhere, the gas that should have time after compression to evenly distribute itself throughout the whole. The labour in well kneading, or in pulling asunder and folding each piece over when throwing out, or in handing up once, then again, closes up the meshes, making them fine and close. If then, however, put into hot oven, before a gentle re-expansion is allowed, the loaf will be close in some parts, but burst out by struggling gas, where exposed to heat, in other parts, that is, it will be uneven in texture, unexpanded here yet holey there. If, on the other hand, it be allowed too much recovery, it will be even all over, not close here, nor holey there, but, although regular, will be uniformly coarse. Two extremes to be avoided.

A fine mesh will almost universally, with only a few exceptions, indicate a long steady process of fermentation with considerable changing of the constituents of the flour in the trough, and also a slow and small amount of proof after throwing out; whereas a coarse mesh will, on the other hand, almost always indicate a quick and short process in the trough with larger quantities of yeast, and also a rapid one, therefore more proof after throwing out, which will be particularly noticeable in quickly blown up and little handled tin bread. Fineness is fermentation or change and labour; coarseness is æration rather than change, and often, therefore, lack of labour at the finish, or, what amounts to the same thing, a greater proof after labour. Ramming one's fist into the dough when in the trough, and letting the gas out, does not put in texture, except that, to some extent, it checks the dough ramping towards too much change, but the dough should be well spread and folded over. A spongy texture usually indicates a desirably lively fermentation and good flour, and thereby, within limits, a sweet and moist loaf; a hard texture usually indicates unripeness, or else tightness; a crumbly texture indicates in either trough or loaf stage over ripeness; a soft, pliable texture often indicates a slack dough, but not entirely so, because a sloppy brown dough often makes a hard and close textured loaf.

Blemishes in texture, namely, variations throughout the loaf in the grouping of the smaller interstices (which although small spaces or holes are distinct from the larger cavities styled "holes" as discussed elsewhere) include, to commence with, a hard layer, which can at once be seen and felt between the top and bottom of a cottage loaf when the latter is cut. The layer meant in this case stretches right across the loaf, is hard and thin like a cord, and so tough that, when the head is pulled off from the bottom, the layer, which is seen to be discoloured, can be easily detached, skinning off like the outside layer of a boot sole that has been partly loosened by wear. This tough layer can only be caused by the top and bottom having been stood separately on the boards, instead of being topped after moulding, and by not being kept moist, and by being stood on cones or dust and thus contracting a dry skin. When the separated pieces are then topped, the two dry and chilled surfaces get pressed together, forming a tough integument that no gas can ærate. Sometimes, and more often, instead of this hard thin core, there will be in the same place a softer and wider layer, about ½ inch thick, which by its greater closeness can be felt and has effect on colour, but cannot be detached from the loaf in the same way as the other when the top is removed. This is often due to the same cause, in a modified form, namely, by the outsides getting chilled and thereby not expanding when in the loaf in spite of being then in the centre of it ; but it often comes even when the tops and bottoms were joined, as they should be, immediately after moulding. It is then due to too much compression in proportion to the state of the dough, either by a big head weighing down the bottom too much or more usually by too much weight of the hand—too much pressing down—when topping or bashing.

The effect of undue pressure can be easily tested by cutting the loaf in halves and then pressing the top, and watching ; the compression will be seen to come exactly in that spot where this layer and compression always is, and not come in any other part of the loaf to nearly the same extent. The hard layer, or core, first referred to, will usually be more noticeable, that is, thicker and more discoloured when using low grade flours, which discolour or oxidise on exposure to the air more quickly than more starchy ones ; and it will be much more often present with long slow processes than with quick, and the difference has been noticed in two such loaves from the same baker. The softer layer, or streak, as referred to in the second place, will very often be seen in good bread, as at the exhibitions, made with highly refined and delicate flour, and by a quick process with plenty of yeast. This layer, or streak, is obviously the result of insufficient re-expansion, and although exhibition bread will usually be given time and proof after moulding for the purpose of this re-expansion to a greater extent than at other times. nevertheless, it is usually made from delicate and highly starchy flour, usually fermented to its utmost to bring out all there is in it, and also usually more tight. These points combined make it more difficult for the loaf to recover itself, and to re-ærate the portion where the pressure most comes, to the same extent as the rest of the loaf from which the gas was pressed out less. A highly refined and delicate flour, as usually used in such cases, does not grow or expand much of its own accord, and a good coloured background in the loaf shows up any imperfections very readily. Other streaks will be found in other parts of the loaf, and are usually the results of the pieces before moulding getting likewise chilled and dry, and then during the course of moulding being turned into the inside. A too liberal use of cones and dust during actual moulding will have a similar effect. Cones, and dust, and skin can be very frequently seen· inside a baked loaf. Pieces of skin turned in will make a core similar to that as described between the head and bottom of cottage.

The writer once closely watched two men moulding a batch of cottages ; one moulded and placed the loaves in front of him, the other moulded on another table and threw each loaf across, falling flat on its bottom with a bang on to the table of the other man. The writer suspecting this rough usage would make a concussion and a layer just where the head joins the bottom in the same way as severely bashing would, marked each loaf, and saw the expected result after baking. Sometimes a suitable oven and suitable access of heat to loaf will partly correct this layer of heaviness by helping to lift and re-expand it. This effect of oven is particularly noticeable in the folds, and the layer of closeness at the sides, in tin loaves. The sides will frequently become chilled by having a warm, free dough, which is more sensitive in this case, put into a cold tin. The tin is, of course, usually as cold on one side as the other, but the layer of heaviness is only on one side of loaf, and this is usually on the side that is the less baked, by being more closely set to another tin, the other side, when correct, having been well expanded by the sufficient heat.

Sometimes this same layer at the sides will come from the loaf proving in the tin a long while and getting cold at sides, but there again only one side is often affected for same reason; on the other hand, a long while in tin will usually make the other parts coarse. Sometimes, as in a recent example, insufficient baking at the sides does not set the crust, which collapses or shrinks at sides, making a close layer. In the same way a loaf that is very fully proved, when put into an oven which is too cold for it, will often collapse in places, making thereby close spots, because the heat was not great enough to lift it. It will drop in oven either by the over proof or the constituents of the gluten, as elsewhere discussed, not being able to withstand the strain; it may also sometimes drop by the oven door being opened to put something else in too soon after batch had been set. The opposite course of action, namely, putting the loaves into a hot oven when underproved is fully discussed under the respective headings of holes and also of shape, as this course more often leads to distortion than to contraction.

The above instances of the heaviness at sides being due to insufficient heat have come under the writers' personal observation, but when recently talking to a Scotchman on this subject, the latter said the layer of heaviness was due, on the contrary, to too hot an oven. He was referring to the usual plain or batch bread, and he may be perfectly correct in that case, because the extra heat by causing extra expansion may jam and compress the close packed sides too much against one another, although, as in the case of tin bread, the extra expansion ought to result in driving the loaf higher. Further reasons, similar to those already discussed above for other varieties of bread, were also given, such as too much highly refined flour, like Hungarian, too much salt and overwork in the quarter. Texture depending on many of the same conditions that favour good pile, it is not surprising to find that no district in the world makes on the whole such fine textured bread as the West of Scotland.

A loaf is said to be of good pile when its gluten has been so changed and stretched as to enable a thin and bright layer of crumb to be skinned, or pulled off, from its side without breaking short. This flakiness or the facility with which layers can be detatched from outside crumby sides is in very close relation to texture, volume, quality of flour and correctness of fermentation, and is not of so much value in itself as it is the index of what the loaf is—what it has gone through. In order to get off this layer from the side of a crumby loaf, the gluten must have been changed on the one hand just enough, and, on the other, not too much. Unless mellowed, the gluten, which, of course, is the webbing of the loaf, and all that holds it together, will not be in a condition to stretch, will not be pliable; but, on the other hand, if changed by fermentation too much, it will have lost its elasticity and break off short.

To get good pile and texture, not only must the gluten be thus properly matured and be in a condition for stretching, but the stretching must be done, the fibres must constantly be stretched and folded over one another whereby they become finer in themselves, their length increased, and the mesh that they make be of smaller interstices. This, of course, means labour, and pile cannot be obtained without labour. But even when the flour is good, and the gluten of it changed, labour will not always make pile. Pile is the well-stretched gluten that gives that silky, glossy look, and no amount of labour will put in that appearance if the labour be applied after the flour is changed too much for it. If, for instance, a dough has got too ripe in the trough before much work is put into it, no amount of cutting back or handing up or braking, will then give the pile a silky look. It is too late. A coarse texture will not give the pile or silkiness like a fine. It is for this reason that many complain they cannot get such an appearance with an off-hand dough as with sponge and dough. The cutting back and handing up twice will not always make up for labour that should have been given earlier. If a sponge has gone too far, no amount of labour would make pile or silkiness out of that particular portion, but such a sponge is often saved, and the pile obtained from a sponge and dough because the lightness (a necessary item in pile) is obtained in the sponge, and then the dough is made with half the total quantity of flour reserved until that stage, which not only levels up possible mistakes in the sponge, but necessitates more labour, and labour at a proper period, amalgamating stable gluten with the weakened.

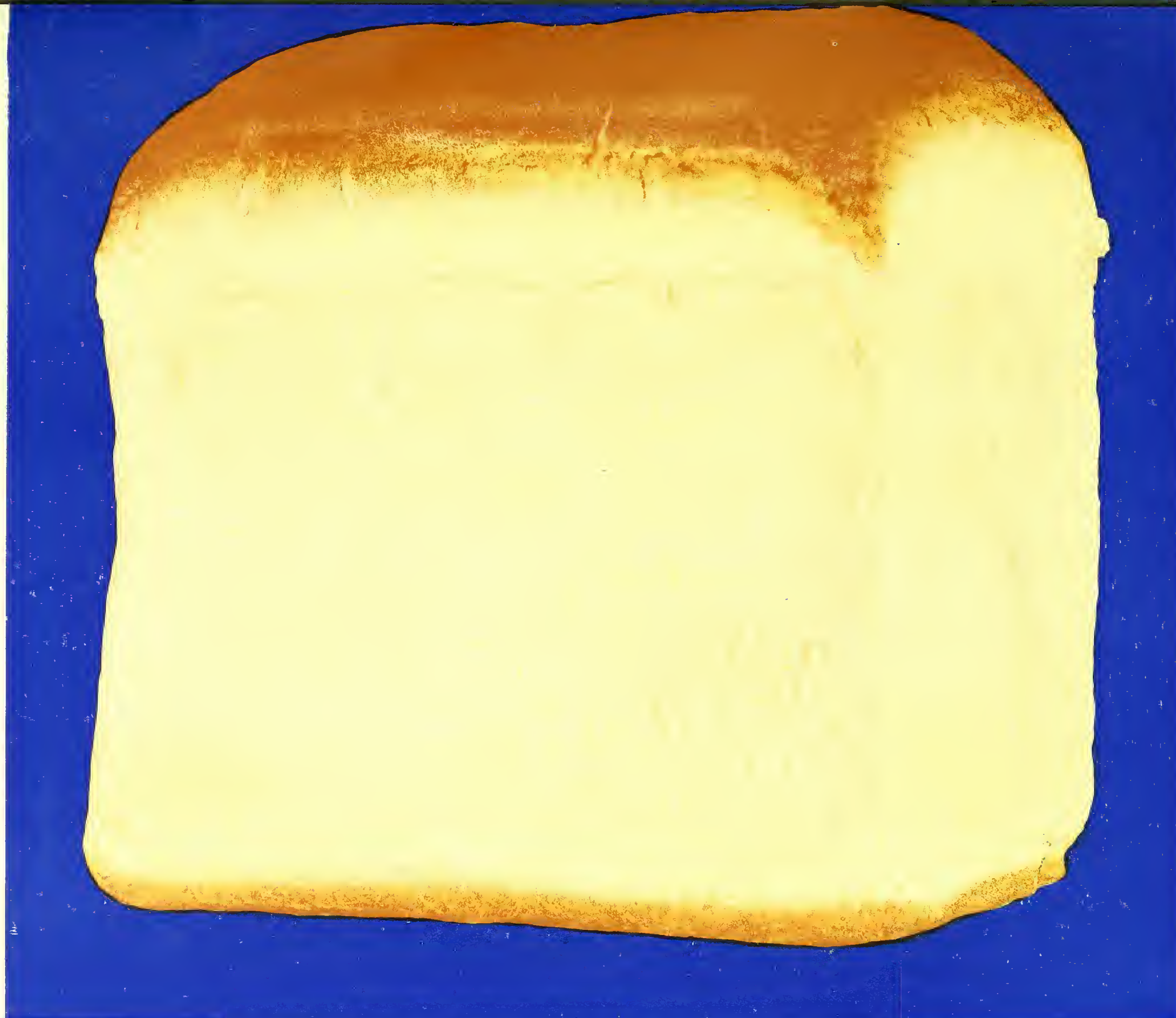
Pile is more heard of in Scotland and Ireland, because in those parts there is more close-packed or crumby or plain bread than here, and it is on the close-set bread that pile is, of course, more noticeable, but the texture and pile that is seen on the outside crumb must, to a certain extent, run through the whole loaf. There is another point about pile that might be mentioned. We have seldom, just of late, had a good chance to judge the pile of a loaf in its perfection so far as such relates to the pulling off or skinning off the layer from side of crumb, according to the well-known test in such cases. Many of the loaves received have been through the post twice, and this skinning off must, to a large extent, depend on moisture. According, of course, to the baking, the time for testing pile in this way, should be about six or twelve hours after leaving oven. The loaf will be too soft before the steam is out of it in order to get the thin layer, and it will be too brittle and unpliable when dry on exterior, although moist enough inside.

We have referred to the generally good pile of Scotland and to over ripeness of flour not making it, the same is also true of naturally soft flour which does not permit of pile, yet the local wheats of Scotland are softer than English. There will not be pile without ripeness but mere ripeness or change will not make pile without a good percentage of elastic gluten. In the same way that butter when incorporated with flour in one manner will make puff paste, and when incorporated in another manner will make short paste, so will differences in dough making affect the pile. We recently had a most conclusive example of this. In the same bakery with the same flour, and in fact with everything carefully noted to be the same, or it would not have been a fair test, several doughs were made in two different machines. One machine was of a very massive type, and having a full quantity of flour added to the water before starting mixing, made with its usual quickness a firm and solid dough; the other machine was less massive and of more gentle action and took more than double the time, namely, exactly fifteen minutes. The flour in the latter case, instead of all being added before starting, was added gradually almost throughout the whole time of kneading and less of it was got into the dough, which by its gradual kneading and greater slackness recovered very quickly when placed in the trough. This produced a plain loaf of most excellent sheen, volume and pile and points ahead of the other. Tightness will spoil pile like unripeness, because the gluten has not only to be present but must also be stretched, and the pieces, although the dough wants to be thoroughly kneaded and firmly handled at all stages, must be taken with plenty of spring left in them. Inattention to these matters will mean on the one hand raggedness and roughness, and on the other hand smoothness and shortness and all the other signs of overwork.

Since writing the main portion of the above we have just received two loaves from Scotland, both made by the same man and from practically the same flour, one from a half sponge system and the other from a straight dough. Although the former is a fair average loaf and nothing to complain of, the latter is without exaggeration the worst we have ever seen from North of the Tweed; it has absolutely not a particle of pile, the finger nails dig into the crumby sides like a piece of cheese, which is quite impossible with the other loaf. It is heavy, dark both inside and out, small, of hard, coarse and uneven texture, and eating with a rawness, the whole fault being a great insufficiency of fermentation.

VOLUME

AT the exhibitions and bread competitions held in London annually the section "Volume" has assigned to it a large proportion of marks, the divisions of which are already detailed in this chapter, it is therefore necessary to see what the term includes. The word Volume is derived from the Latin *volutum*, meaning rolled, and originally meant merely a roll, as of parchment; it then came to mean that which the roll contained, and then



SCOTTISH CHAMPION BATCH.

the size of the thing contained. It now would often refer to the size or dimensions of an article, but in the case of a loaf of bread, which one occasionally may hear described as "too large," it possibly in the mind of a bread judge includes other points, especially as the other sections, namely, colour, flavour, and texture leave some excluded. In addition to size, therefore, it possibly includes proportion, shape, and general outside appearance.

Regarding size, it is hardly quite correct to call a loaf too big. From a buyer's standpoint, a larger article of daily consumption, all other things equal, is better value for money than a smaller, but if the extra size interferes with the other points or qualities, it should be the other points that should be noted as deficient rather than the volume as excessive. In other words, if the materials and manufacture have allowed the other points to be reached with perfection, then the bigger or better volumed loaf must be the better, and be entitled to first place on that account. In this connection it would be as well to remind competitors of a little fact they seem to so often forget, namely, that 2 lbs. 4 ozs. of dough will make a bigger loaf than 2 lbs. without detraction of quality in other points. Large volume presupposes an active and ripe fermentation, and a flour with a good percentage of gluten of the right character. The gluten not only has a natural expansion of its own, but also enables a loaf to be of good volume, because of its balloon-like connection with the gases evolved during fermentation.

Labour, as in the case of pile, has also a considerable effect on the volume of a loaf by the stretching and folding of the gluten, as seen in some sorts of bread, especially on the continent. Laziness and insufficient manipulation in conjuction with a good percentage of gluten will not give such good results in volume, pile, and lightness as judicious extra manipulation in conjuction with a smaller percentage of gluten. Moreover, the quality of the gluten, as more fully discussed under that heading, has more effect on volume than the quantity of gluten, by reason of better holding the gas and stretching with more elasticity.

Although a naturally soft flour, or a flour with a big percentage of starch, will usually tend to decreased volume, owing to the usual variation in the proportion of the constituents of the gluten in such cases, it has been found that if starch be artificially added to a flour, that the effect on volume is not great. Ten per cent. natural variation in the quantity of starch in two flours would be excessive, and would have a far greater result on volume than if 10 or even 20 per cent. be artificially added, because in the latter case the constituents of the gluten, namely, gliadin and glutenin, would still be in the same ratio to one another. In the same way it has been found that when the percentage of gluten has been artificially increased by removing some of the starch, that the volume has not been correspondingly increased to the same extent as it would have been by a flour naturally containing extra gluten. It will be further noticed, however, that a flour naturally containing a large or an excessive amount of gluten will not increase the volume as compared with a flour with a normal amount, in a ratio corresponding to the increase of gluten.

The above facts are of the greatest importance, and are the whole base and reason for the advantages derived from blending wheats and flours. In addition to the amount and character of the gluten, there are the further points of the degree of fermentation and the amount of proof and gas in the loaf when about to be baked. The gluten must be mellowed or peptonised by fermentation in order to stretch and expand, yet must not be too much changed or it will collapse. Fermentation is usually considered to increase volume, and in long steady processes, divided into several stages, as in Scotland, this will usually be found to be so; but when fermentation is ripe, there will be a gradual shrinkage from that point, the meshes close up and tissues contract, and a sour loaf will, all other things being equal, usually be found smaller than if taken sooner. A loaf cannot be of good volume without gas, and gas can be absent by the fermentation being excessively young or immature as well as by the fermentation having past its normal and vigorous stage. Our remarks elsewhere on proving and baking show how volume will be effected in the same way as shape, which also is separately discussed. A hot oven will usually lift and increase volume, according, however, to the proof. In a cold oven a young loaf would grow larger by getting better proof, but an overproved one would drop. Water in medium quantity, other things equal, will be better for expansion and volume than not enough, but in excess will tend to closeness.

DRYNESS

DRYNESS in bread is a subject of very considerable importance, and is a defect of comparatively recent growth. It might often be defined as absence of moisture, but it is not always so, for instance dryness or thirst is usually produced by a deficiency of liquid, although some liquids, such for instance as sea-water, considerably increase the thirst. In the case of bread, dryness is attributable largely to under-fermentation on the one hand, and over-fermentation on the other, and also as discussed under the heading of baking, by being too long in too slow an oven. In order for a loaf to be moist it is evident that a sufficient amount of water must be added, and, all things equal, a slack dough is usually found to make moister bread than a tight one, but it is not so much the amount of water that is added that keeps the loaf moist, as the way in which the moisture is retained.

One of the chief factors in the retaining of water is the gluten, not only according to the percentage of the latter, but also according to the varying percentages of the constituents of which it is composed, and which have been considered under the separate head of gluten. For the moment it will suffice to say that glutenin will hold water better than the gliadin. If fermentation be incomplete there will be insufficient soluble matters formed, and if the fermentation has proceeded too far, the soluble bodies that were formed will have been consumed. It is easily seen therefore that in either case the result will be dryness, because the moisture of the loaf depends more on the amount of water that is combined with these soluble matters, than on the amount of water that, being unamalgamated, would be more easily evaporated or driven off.

There are really two kinds of dryness as the result of the two different causes of under and over-fermentation, and they can be distinguished from one another on the one hand by the well-known characteristic of flinty crust, and, on the other hand, by a crumbly or sawdust dryness in the crumb, as discussed under the heading of crumbliness. Although steadiness and slowness of fermentation tends towards moisture, it is not true that heat always makes for dryness. One can have a dry loaf with a long, slow fermentation, or one can have a moist loaf with quick and hot fermentation. The difference is merely the amount of change of the constituents and the extent to which they are allowed to be unconsumed, and the rapidity of the change can have no direct effect ; but with the quick system where the changes are proceeding more rapidly, more precision is required, and any variation one side or the other would have more effect. Analogous cases can be taken of a fast and of a slow train, or of a man riding a bicycle or walking, all will usually arrive at their destination safely and well, but any accident or irregularity will be proportionately more severe when travelling at the quicker rate.

We have mentioned above the broad fact that dryness is not only affected by the amount of fermentation and change of the gluten, but also by the percentage of the latter that is contained in the flour. It has been found by experiment that where the moisture contained in a loaf when made from a normal flour and tested twenty-four hours after baking was 38 per cent., when 10 per cent. of starch was added the moisture at the same period was found to be only 34 per cent., and when 20 per cent. of starch was added the moisture was only 33 per cent. Not only was the dryness thus measured, but the bread could be easily seen, by casually examining it in the usual way, to be dry and hard, which is a similar effect to that which is obtained when bread is made from flour that naturally contained a larger percentage of starch in proportion to gluten, such as is the case with flours produced from very starchy wheats, that are usually reserved for biscuit-making. Moreover, exactly the opposite result was seen when some of the starch was washed out from the dough, whereby the percentage of gluten left behind was of course increased.

Exactly the same effect has been noticed also, in the ordinary way of business, when highly refined cornflour has been added to the batch, the cornflour, being the starch and product of maize, having none of the characteristics of gluten contained in wheat. And further the finely dressed product of maize, which is known commercially as cornflour, the same as that from which blanc-manges are made, was found to make a very much drier and more bound loaf than the coarser ground and dressed product of maize, known as maize flour. It was also found that where maize cones, as usually used in the bakehouse for preventing dough sticking, had the same effect of making bread dry, these coarse cones had less effect in this respect than fine cornflour. When mixing this cornflour and also wheaten starch with ordinary flour, no material difference was noticed in the amount of water which the flour absorbed, the dryness therefore was the result of a greater amount of the water originally added being evaporated. Although starch, when thus in its raw state, has this effect of making bread dry, it is not in all cases that decreasing the gluten would increase dryness. It is not found so when this starch is scalded, cooked or gelatinized, as it is sometimes called. The effect then is exactly the opposite, the dryness is decreased, the moisture being permanently increased, because of the starch being rendered soluble and taking the water up into its own constitution. This addition of scalded flour will be further considered under its own heading and also under the heading of yield of bread, but in passing it might be remarked that, according to the quantity used, the moisture of the bread has been increased to a greater extent than when using normal quantities of sugar or malt extract.

There are also other substances that, although they decrease the percentage of gluten, which decrease was seen under some circumstances to make dryness, are used with satisfactory results in different districts. One of these is lard which keeps the crust moist and short, but the use of this, particularly in ordinary bread in England, is an exception. It is largely used in America, and to a smaller extent in some sorts in Scotland, but in respect to the present subject of dryness it has practically no effect in the proportion of less than 2 or 3 lbs. per sack of 280 lbs., having in that quantity less effect than malt extract. In this respect it would also be as well to mention that in this country, it is popular to say that American flour is dry and makes dry bread, but the bread made in America with large quantities of lard, malt extract, and oftentimes other matters, has not earned the reputation of being dry. It may be said however that American bread is more often baked in smaller loaves than ours, being well crusted and more generally eaten when new.

The addition of lard seems to increase the percentage of glycerine which helps to retain water. This glycerine is normally produced in small quantities during ordinary fermentation; it is added in this country to cakes and found to keep them moist, and there are some in America that add a pound of it to each barrel of flour, ten barrels (196 lbs.) being equal to seven sacks (280 lbs.). This glycerine is best dissolved in hot water and added with the remainder of the liquor, but many prefer to get similar results by adding double the amount of glucose.

When the water of a loaf dries out, making the bread stale, the result is not only seen in the dryness, but also in the hardness of the loaf. When, however, the above matters are freely added, the loaf is very much softer and moister to the feel, and the crumb does not seem to fall away into such fine crumbs. This is seen in the case of lard. Although as said elsewhere large additions of scalded flour are apt to increase crumbliness as soon as the water has evaporated, the degree of this evaporation according to the length of time of baking, or the heat of the oven, has already been said to be greater when baked for a long time in a cool oven, than when baked for a short time in a hot one. This will be further affected by the spacing of the loaves in the oven, namely by the amount of crust, the moisture evaporating subsequently less quickly when there is crust all round than when a loaf is crumby set. On the other hand in the case of cottage loaves where the top happens to be very small and the crown of the oven very hot, the top will thus be baked quickly, and it would be an advantage to it if drawn from the oven when baked, but by not being drawn until the whole is ready it naturally gets over-baked which of course is a cause of dryness in that particular part, too much water being expelled in the first instance although leaving less to be evaporated subsequently. All other things being equal, the bigger the volume and the coarser the texture, of course the greater will be the natural evaporation. Up to a certain point, however, it is most likely to be moist if spongy and pliable, as that is a sign of good aeration and quality of gluten. To some small extent the amount of the kneading will have effect because, with time for recovery, kneading and well mixing makes the dough pliable, and a pliable crumb is not usually dry. A pliable crumb often indicates a slack dough.

The presence in flour of germ, which contains oil and fat, has effect in keeping the loaf moist, as can be seen by getting some germ from one's miller and adding a small portion of it to the flour. Its soluble and unstable character renders its removal by the miller necessary because it deteriorates on keeping, but when added in a fresh state it has a welcome effect for a change. Although one is always far too ready to blame the flour for any undesirable characteristic of the bread, it is very frequently noticed that when, from some cause or other foreign flour is very cheap and thus used in greater proportion, and although it may not be the fault of the flour, it is nevertheless then that we hear more complaints concerning dry bread. And recently on the contrary, when harsher flours have been less used, no matter what might be the reason, it is equally true that the complaints of dryness have been less. Not only the condition and characteristics of the wheat, but also the way in which it is milled can have considerable effect, when the degree of fermentation is the same in all cases. The fineness, referred to above, in the case of the cornflour is also seen in the fineness and dryness of wheaten flour. Highest-priced flours when obtaining that price more on account of their fineness or their small percentage of the total flour, rather than on the differences in various qualities of wheats, often tend to dryness. This is seen in the case of high-priced Viennas, the highest grades of which are often only a 5 per cent. patent, and bread made therefrom is usually dry and insipid, which would be particularly noticeable in the so-called Vienna bread made in this country, if it were not for the shortening or other materials added, and it is still more so when such doughs are made with too little water.

The practice of washing wheats for removing dirt, or damping the bran to render subsequent milling easier, is not done with the view of increasing moisture in the flour, in fact, on the contrary, where wheats are milled in damp condition there is usually a smaller percentage of flour produced, and damp flour is always a considerable nuisance in decreasing the capacity of the machines, or in clogging the numerous spouts present in modern roller mills. In respect of dryness, it will thus often be found that straight run flour from a good grist of wheat, well milled, will be better than a smaller percentage of a worse grist. Large and small quantities of yeast would by themselves have little effect, the moisture depending, except for the reason as given above in the case of heat, more on the amount of the fermentation and degradation than the speed.

Staleness in bread is not entirely a question of loss of water, the crumb of new bread usually containing from 38 to 48 per cent. of moisture and the crust from 16 to 24 per cent. according, of course, to the extent of baking. When the loaf becomes stale the inequality of the water between its parts decreases, the crust absorbing some which the crumb had. If a loaf with a dry crumb is again put into the oven, it would be found that the crust again becomes drier and the crumb moister, and although the loaf as a whole would not contain so much moisture as when new, it would by the second baking seem very much moister thereby, although it would more likely, more so than before, soon again become hard and dry. A loaf during baking, according to its size, shape, and other conditions already mentioned, will lose from 2 to 4 ozs. on the 2 lbs., and more in exceptional cases; a reasonable amount however being about 2½ ozs. What it loses after leaving the oven will also depend on the condition under which it is kept. It will lose if kept under good conditions fully 1 oz. per day for the first two days, it will usually lose more, naturally, on a hot dry day than on a cold and moist, and as a matter of personal experience a loaf taken out on the top of a cart during the afternoon in the ordinary course of serving customers has been found to be 2 ozs. less on arriving home than when starting, even although it had previously lost some during the course of cooling.

White bread, it is safe to state, contains from 37 to 40 per cent., and sometimes more of water; that means about 12 ozs. water in a 2-lb. loaf. The majority of this water will evaporate under natural conditions, and all could be driven out by special treatment. The first few ounces will be lost very rapidly. Some time ago we received by post a cottage loaf at 11 A.M., which was then probably twenty-four hours old, and which, from previous experience, had in that time lost fully one ounce. When put on the scale on arrival at 11 A.M., it was exactly full weight, fully keeping down the scale beam on its own side. Being left there on the scale untouched until 11 P.M.—twelve hours—the scale beam was seen to have changed position, the loaf having lost enough weight for the beam to rise of its own accord on its own side, and of course be depressed on the other, and more than half an ounce weight was necessary to again balance. Fifty hours after arrival, it was 1¼ ounces short, although except for the first twelve hours after arrival it had been kept under best conditions for moisture in close contact with other bread and covered by a cloth. In many cases, such as when exposed to the draught, and oftentimes sun, on the top of a van, the loss would be very much more. The natural moisture in flour will vary from 9 to 14 per cent., and taking 12 per cent., as a good mean for flour milled in this country, that would be 33½ lbs. or nearly 3½ gallons in every sack of 280 lbs., and to this, in order to make dough, a further 14 gallons usually, but varying from 13 up to 18 gallons, would be added by the baker. The term dryness as applied to bread is therefore relative only and not absolute, being a mere sensation, because the driest of half quarterns is seen to be composed of about one-third of water.

CRUMBLINESS

CRUMBLINESS in bread, like so many other defects, is said to be produced by a number of different circumstances, but, on close examination, it can always be said to be caused by the flour being unable to withstand the strain to which it is subjected. The effect of the strain is, of course, in proportion to the quality of the flour, and the strain can be given in different ways, but crumbliness is more frequently due to over-fermentation or overproof than anything else. It is very seldom that heavy or underproved bread crumbles, crumbly bread usually being very light. Also, the drier the bread the more it will usually crumble, as borne out by the fact that a loaf will crumble, when once the steam is out of it, more, and in finer crumbs when stale than new. It is oftentimes not fair to test crumbliness by cutting the loaf when hot, as the drag of the knife will depend much on the sharpness of it, and the way in which it is used. A sawing action makes a very much cleaner face than any attempt to push the knife through it as if cutting a piece of cheese ; in fact, such a loaf is a torn or jagged rather than a crumbled one, because, although it is difficult to spread slices, there are really no fine crumbs produced. Crumbliness, like so many other features in a loaf, depends largely on the gluten, that is, the way in which the threads of gluten, that are present throughout the loaf like a net, are able to hold together the other portions of the loaf. Gluten requires a certain amount of fermentation and moisture before it is the perfection of elasticity and tenacity ; it then gradually loses its capacity for binding the loaf together, and anything that weakens or decreases the percentage of gluten on the one hand, or anything that toughens it on the other, must therefore have an effect on crumbliness.

Labour and salt have a considerable effect in checking the weakening and peptonising effect to which gluten is subjected in fermentation. These points, together with the lowness of the temperature and the strength of the flour, are those which enable the long sponge process in Scotland to be attended with far less effect on the crumbling of the loaf than a similar time when given under other conditions typical of other parts. Salt frequently not only steadies the fermentation but has a binding influence. It is frequently noticed during flour testing that if one has two glutens, one exposed to the air, and the other under water, that, when proceeding to test them shortly afterwards, the one that has been kept moist stretches most without breaking off short—in other words, it has become mellowed, and had its properties developed, and thus able to stand the strain better than the drier and unmellowed one. This same characteristic will sometimes be seen in tight dough which on baking cracks and bursts, whereas a slack one, under the same other conditions, stretches and expands evenly. In the same way a tin loaf, that is not overproved, will have a nice, light, pliable crumb, and not be in the least crumbly.

There is therefore no necessity for a tin loaf to be crumbly, and the reason that so many are, is because they are usually, in mixed batches, moulded first and set in last, and made to subject themselves to the convenience of the remainder of the batch, and not only become more proved than the remainder, but frequently too much so. Except for over proof, the slacker the dough the less crumbly it is likely to be, because moisture will always of itself have a restraining effect. Crumbliness is usually the opposite of harshness. With more freeness in the trough than anticipated, an extra knock down or turn over before throwing out will frequently prevent the loaf from being crumbly, because crumbliness can come from over-fermentation in the trough as well as overproof in the moulded loaf stage, either in the case of a tin or a cottage loaf. When a loaf is under proved, it is often irregular in texture, that is, it may have large holes in some parts at the same time as a fine texture in the rest of the loaf; but when a loaf is over proved, it will frequently be of regular texture, that is, it will have neither large holes nor fine texture, but have a uniform coarseness. It is this even or uniform texture and coarseness that results in crumbly bread, crumbliness being oftentimes the result of too much recovery after moulding, as opposed to holes being from insufficient recovery. With loaves of the same evenness of mesh in the texture the difference in the crumbliness will often be the amount of moisture, a moist loaf crumbling less than a dry one. It is here that the oven may have effect, and crumbly loaves, the same as dry ones, will very often be produced by baking too long a time in too slow an oven.

It is sometimes said that insufficient soaking or baking to the centre causes crumbliness, but certainly the opposite is far more usual. Of course, however, where the loaf is overloaded with water, and the gluten be overtaxed, it is a case of the load or strain being too much to carry, and is hardly normal in white bread, although it will frequently happen in brown. Loaves that have been made from long process are not only weakened in their gluten but, of course, require longer time for baking, and there can be cases where insufficient baking does not harden or hold together the particles as it should do, and allows them to become coarse.

It was remarked above that anything that decreased the percentage of the gluten would have an effect on crumbliness, and we have in this connection frequently noticed that the addition of large quantities of scalded flour have caused loaves to be crumbly when stale, although not so noticeably when still moist. We have also noticed that the addition of lard in ordinary loaves has a tendency to make them crumbly, although there are plenty of cases, such, for instance, as in French bread as made in Scotland, or the tea bread from the same place, where they have been perfectly firm and solid in cutting, but then the dough has frequently been considerably laboured and toughened by a brake or otherwise. In the case of cakes, with which we are not so immediately concerned, crumbliness is usually due to excessive lightness, and reducing the chemicals or adding stronger flour has frequently been found to be a cure.

SOURNESS

BREAD cannot be sour without acid, but bread containing acid is not necessarily sour. It is a question of degree. Before further going into the question, one can at once say that as far as the baker is concerned, sour bread is practically always the result of too much fermentation, that is, too long a process of bread-making, the time being in proportion to the speed.

The acids found in sour bread are lactic, acetic, and butyric. The lactic is the acid of sour milk, and exists in sour bread to a greater extent than the acetic and butyric, and is thus often said to be the cause of sourness. Sour bread, however, not only tastes sour, but smells sour; and lactic acid, although usually accompanied by other odours, is itself perfectly odourless, or without smell. The proportion and amount of these acids in sour bread will be governed by the variations and extent of different systems of bread-making, but the lactic will often amount to 85 to 90 per cent. by weight, whereas the acetic will only be about 5 to 10 per cent., and the butyric very much less still. The latter, however, by its objectionable character is far more noticeable than its weight would indicate, and the actual percentage of acid present is not always an absolute verdict as regards the sensation of sourness in the bread; because not only are some acids seen to be more readily detected by the senses of smell and taste, but also the larger amounts of salt employed, and even the coarser or stronger flavour of some flours will counteract or hide the presence of the acid in different degrees. Lactic acid is, undoubtedly, always present in dough, and it is only when allowed to get to excess, or when the sugars and flavour of the flour are exhausted by too much fermentation and not replaced by some other flavour, that its acidity strikes on the palate, giving what is called sour bread. This principle is further dealt with under the heading of flavour.

In some bread there will not be more than about four or five parts of acid in 10,000, but there must be much more in Scotch bread, where the presence of lactic acid is rather preferred than otherwise, being liked for its action on the gliadin of the gluten as well as for its flavour; and it would be awkward, in the presence of a powerful Scot, to call his bread sour. At one time one used to hear sour bread attributed to disease germs in the yeast, which could be seen by the microscope, but on the principle that a germ cannot produce its by-products when surrounded by an excess of them, the lactic acid germ sometimes is largely added in the preliminary stages during the manufacture of yeast, so that it should not produce so much acid afterwards. The lactic germ is smaller, yet quicker in its action than yeast; it ferments glucose like yeast, but instead of producing alcohol and carbonic acid gas, except in traces (it is stimulated rather than otherwise by the latter gas), it makes lactic acid. The sugar of milk is its best food in a temperature of 90 to 100 degs. F., and it is checked by alkalies as well as strong acids.

Acetic acid, or vinegar, is produced from alcohol by the action of free oxygen. At one time it was thought that this combining of the alcohol of the dough with the oxygen of the air, otherwise called the oxidation of the alcohol, was the cause of sour bread, by reason of the production of acetic acid, which, however, we have seen above is but a small proportion of the total of the acid of sour bread. This reaction is employed in making vinegar, but the action takes place only by extreme exposure to the air, and for a long period, and is altogether too slow to be compared to the formation in the bakery of acids by fermentation. Like the lactic, it hastens fermentation and peptonises or mellows the gluten. The butyric germ, on the contrary, does not want free oxygen, and hinders fermentation, and although it develops at less, it likes best a temperature of 105 degs. F., or about 10 degs. more than the acetic germ. It derives its name from its connection with rancid butter, in which it largely exists, but it can be obtained from starch products and lactic acid.

The acids produced in bread-making are mostly organic, lactic being the chief, by the splitting up of the compound starch and sugar into different products than those produced by yeast ; it is therefore not difficult to understand the important fact that a vigorous yeast fermentation, provided it be stopped soon enough, is a most effectual check to the development of acid or sourness. This is abundantly proved to be the case in practice, because now that short processes with larger quantities of yeast are more used, there is certainly less sour and twangy bread than there used to be ; and amongst the hundreds of loaves we receive from all parts of the kingdom, we have had plenty of sour and nasty ones from long processes, but seldom any from a quick and short system. The whole purpose of this book is to avoid long words, dry matter, or matter difficult to understand ; and we had some hesitation to insert the following formulæ, for the fear of their looking too chemical or too advanced, but they are really very simple, and so clearly summarise much of what has just been said, that they cannot otherwise than help towards understanding.

In healthy bread fermentation by yeast the starch is first changed into maltose (and dextrine), and then into glucose, and then the glucose into alcohol as follows :—

$$C_6H_{12}O_6 = 2C_2H_5HO + 2CO_2$$

Glucose into Alcohol and Carbonic acid gas.

Then the alcohol is changed to acetic acid thus—

$$C_2H_5HO + O = H_2O + C_2H_4O$$

Alcohol with Oxygen into Water and Aldehyde.

Then—

$$C_2H_4O + O = HC_2H_3O_2$$

Aldehyde and Oxygen into Acetic acid.

The lactic is derived thus—

$$C_6H_{12}O_6 = 2C_3H_6O_3$$

Glucose into Lactic acid.

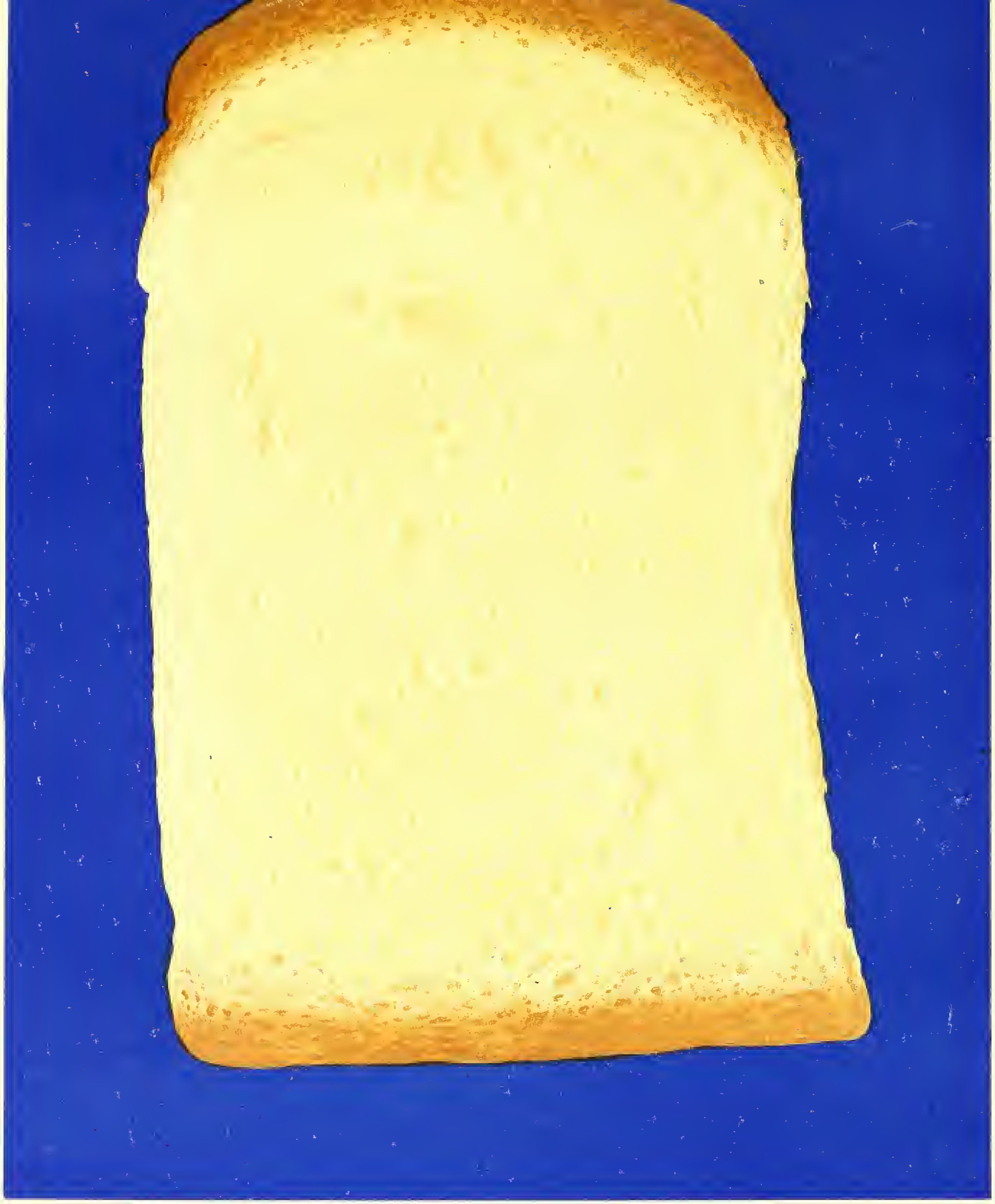
The butyric is derived thus—

$$2C_3H_6O_3 = C_4H_8O_2 + 2CO_2 + H_4$$

Lactic acid into Butyric acid and Carbonic acid gas and Hydrogen.

Commercially we cannot exclude these foreign ferments ; we may buy the best flour, the purest yeast, have our bakery furnished throughout with glazed tiles, frequently washed down, have all tubs, tables, and troughs scrupulously clean and pure by means of the live steam jet or the solution of bisulphite of lime, but even then we must make up our minds to have these aids to nature always with us. Twenty ruffians in Trafalgar Square without a policeman will be more dangerous than twenty thousand in Hyde Park under proper control. We cannot purge society of its blacklegs, so we make laws and appoint custodians of those laws. Likewise we cannot annihilate lactic germs from our bakeries, but we can decide upon rules, and place a strong cordon of yeast cells over the unruly. It is a question of roughs *v.* policemen, or yeast *v.* souring bacteria. The power of one organism to overthrow or check another depends on the relative numbers of these originally present, the medium in which they grow, and the temperature. Both yeast and the souring organisms will up to a certain point become more active with an increase of temperature, but if yeast be in the ascendant, it will still more be so if accelerated anywhere up to 95 degs. F., and practice blames theory for saying that (as lactic, acetic, and butyric ferments flourish best respectively at 95 degs. and 104 degs. F.) sour bread is thus accelerated by the increase of temperature. Some writers claim that this theory of increased temperature producing sourness is borne out by practice. It is true a warm and free sponge or dough, by reason of its extra speed, will more quickly run over the precipice if not stopped, but it is the neglect to stop, and not the temperature, that has done the mischief.

With impure yeast (if enough of it and worked freely) and inferior flour, with many lactic germs, it is possible to make sweet bread ; but the best of yeast and the best of flour is no absolute immunity against sourness. As long as the yeast is more vigorous than that of the souring germs, and thus sets up a more powerful molecular motion (similar to the conduction of heat) on the area of the sugar and nitrogen supply, it has a first claim on these stimulants to the detriment of other organisms which are less numerous or less stimulated. When the yeast begins to flag, either by reason of the harmful accumulation of its by-products, or by the consumption of the sugar and nitrogen in the form required, and has so changed this nitrogen to render



SECTION OF SCOTTISH CHAMPION BATCH

it suitable for the lower organisms, these lower organisms no longer have even their comparatively unsuitable food wrested from them. But, on the contrary, they have ample supply of less complex molecules of sustenance, and as their acid products are not consumed nor then hidden by other flavours, they accumulate apace, and their products taint their bed. If fermentation had been stopped by baking earlier, all mischief would be saved; and the period at which the flagging of the yeast occurs and the acid products of the lower germs accumulate, must depend on all the various conditions of fermentation elsewhere discussed. It is not strictly scientific to imply any battle of the germs, but the point desired to be emphasized is that in practice sour bread, with similar materials, barely ever comes with a lot of yeast, worked vigorously for a short time, and is far more general with small quantities of yeast, worked sluggishly over a long period.

The yeast does not flag entirely because it has no food left, as it is quite possible, as illustrated personally by experiments, for it to starve even in the presence of abundance of sugar. Each organism becomes accustomed to certain conditions; as these become unfavourable less proportion of their specific products are formed. Yeast without nourishment undergoes changes as regards its by-products very similar to that of putrid fermentation. When it is under conditions of moisture and warmth suitable for growing and feeding on the food which is not present, it feeds on its own protoplasm, decreasing it in weight and producing acetic acid. Yeast can produce a certain amount of acetic acid, but the amount is largely increased when feeding on itself or "softening." Acetic and lactic acids are more appreciably formed with free oxygen, but the butyric ferment is best without. Butyric and acetic, unlike lactic, have both a characteristic smell, and the remark concerning the formation of acid when the yeast is weak, will apply more to these than the lactic. By reason of lactic acid having no smell, it would be possible for a dough to be sour to the taste without being detected by the usual test by the nose, if other acids had not been allowed to be produced at the same time.

Although one has said the mere presence of these disease germs will not necessarily make a loaf sour, there are more of them in low grade flours, and bad yeast, and dirty utensils than in better materials, and in that case more precautions would have to be taken to prevent their development. This is particularly true concerning the butyric. The more the yeast was impure the more it would likely to be faint, not only because of the impurities but also because their greater presence would often indicate a yeast of inferior manufacture in other respects, and a greater quantity of yeast would then be required to get the same amount of vigorous fermentation. Some people reduce the yeast the next day after getting sour bread, or keep back a dough by taking it up cold when the sponge has dropped too much, but there is far more sour bread made by too little yeast and too low a temperature than by a lot of yeast. Extra yeast has never of itself produced sour bread, but has often saved it. For instance, with an overwrought sponge the right thing to do would be to add more yeast when making dough, and take it warm, and then throwing out and getting into oven quicker than usual, and into as hot an oven as possible. It would also be advisable, if possible, to make a bigger dough than originally intended, whereby the sourness of the sponge would be more distributed and less noticed. It is on this principle that a piece of leaven, which is sour dough, is made into a batch of sweet, crusty, and crisp bread. It must not be forgotten that a sponge or a dough, like a pear or any other fruit, often takes a long while to get to maturity, but when once there it decays or gets rotten with inordinate speed.

Irrespective of taste and smell, a sour loaf can usually be detected by the eye. It has been shown that when the dough has been over-fermented the gluten has been so changed in character as to take very little, if any, bloom, or healthy crust colour, even if baked in a hot oven. The crust will be grey, without gloss, without brightness, and have no roughness between top and bottom, and be generally smooth and dull, and with dark or purple edges, particularly where the heat has not much access. The crust will be sunken and skinny, and be in putty-like ridges. The crust will splinter too much, and the crumb will crumble. The loaf will be shrunk and not well expanded by the baking. The crumb will have gone back in colour, and will be of close texture, fine in most places, and without small bright holes distributed throughout the loaf, but probably a big one here and there. The head, in the case of a cottage, will, when pulled, come off in the hand with very little resistance, and will be often almost falling off. The shiny corners and dark patches further indicate the state of the interior, and the whole, even at a distance, is instinctively repulsive.

ROPY BREAD

ROPY bread may be defined as that bread which, when broken asunder, shows fine silvery threads. Characteristics that accompany, although not necessarily constituting it, are a soft, wet, sticky and clammy crumb, and oftentimes, although otherwise of ordinary external appearance, a red and immature crust. Another feature usually accompanying is a characteristic putrefactive smell, which, however, is not necessarily the work of the ropy germ alone, but also of other germs which obtain the opportunity to function. When yeast acts on soluble starch and sugar, it is inverted into maltose (about 80 per cent.) and dextrin, then into glucose, which is finally, with traces of glycerin and succinic acid, changed into about equal weights of alcohol and carbonic acid gas. When the ropy or viscous germ acts on glucose, the result is a peculiar sugar, known as mannite (50 per cent.), and a gummy substance similar to dextrin (44 per cent.), and carbonic acid gas (6 per cent.).

Amongst the causes that have been suggested, dirty troughs are usually the first named. We know where the lining of a trough was taken out and fully half a bucketful of the usual evil-smelling slime was removed from behind, yet the owner had been there many years, and had also worked a long process, with brewers' yeast, which is often blamed, yet never had rope. We also have exhibited a loaf made entirely of such matter which had no yeast in it whatever to check the ropy germ, it was also made slack, and then under proved, and then baked in a cool oven, all of which are said occasionally to be causes, but there was no rope. Some of the last ropy loaves we received came from an efficient factory of only a few weeks old,—with glazed tiles and movable troughs, etc., etc.,—which was said to be spotlessly clean. Other men have still had ropy bread after cleansing everything with antiseptics, and we have made good bread in a trough that was blamed for the disease.

Uncleanliness may conduce, under favourable circumstances, to the breeding of the germs that give rope, but before bread can be ropy, the germs must not only be present, and also in large quantities, but also must have opportunity to thrive in the dough, by not being outnumbered or held in check by the yeast. They must have strength, suitable temperature and moisture to develop and make their products after the yeast has ceased to work, oftentimes after going into oven. It is a case of germs + medium + opportunity. Sometimes the disease will have sufficiently developed to be discernible when drawing batch, but more usually it will not show itself until the next day or day after. The flour is sometimes given as the cause, and certainly flour from sprouted wheat would give a better medium. We know of three batches made all in the same way in every particular, excepting that the third and only ropy batch was made with lower quality flour. That would perhaps convince some it was the flour, but in a certain large town very many people had ropy bread at the same time, but were not, of course, all using the same flour, it having come, as usual, from many districts.

Ropy germs are often found in the wheat husk, and, of course, there is more of the husk in cheap flour than in the best flour, and, likewise, more still in wholemeal. Ropy germs are present frequently in malt, but we have made loaves, and wholemeal ones as well, with an excess of malt extract which were clammy and sticky, and kept so for days, but were not ropy. Moreover when pieces of dough from the same batch were held over and given more proof even the stickiness disappeared, the loaf of the series that was baked last being quite free from the excess, the yeast having consumed it.

In the same way yeast will eat up the gum formed by the viscous ferment, if the yeast be stimulated or fresh be added. The published experiments of the celebrated chemist Heron show the ropy or viscous ferment to be present in practically all yeast. He rarely examined a sample without it, therefore one cannot lay the blame, as many do, of the sudden appearance of ropy bread to the variety or any particular sample of yeast. Bread made without yeast (and also, of course, cakes) is also sometimes affected. More aeration and more baking would help to correct the evil, although seed cakes are usually most affected and are not so heavy as others. The same chemist found the ropy germ even in the shavings that had been planed off tubs and utensils. "Invariably found them teeming with rope."

Some blame the potatoes. The viscous germ is sometimes called a potato bacillus, being so named because it was first discovered in a potato, and is usually present in the skin and eyes. But we get plenty of ropy bread without potatoes. With slack doughs, the loaf, of course, takes longer to bake, and the moisture left is more likely to be greater, and moisture helps development of germs like viscous ones, which withstand heat of oven better than yeast. Although the immature ones are killed, many of the stronger ones can live in the crumb after baking. They have been known to stand boiling for five hours, and, of course, the centre of a loaf does not much exceed boiling. If baked in smaller loaves heat not only penetrates easier, but more of the loaf is subjected to the crust temperature, which would be approaching double that of the crumb, and no germs grow in the crust.

There are several sorts of ropy germs. Under 70 degs. F. they grow very slowly. The *bacillus viscous* flourishes best at 86 degs. F. according to Schutzenberger, and the so-called *bacterium viscous vini* best at 60 to 62 degs. F. When two loaves taken from same batch were placed after baking to cool in temperatures of 104 and 40 degs. F. respectively, one was ropy and the other not, a warm close atmosphere considerably stimulated the development of the ropy germ. Cases have been known with loaves from same batch where some were kept in the bakehouse, covered over with sacks, and some taken up to the cool shop, being, as far as could be ascertained, the same in all other respects: the former were ropy, the latter were not. Bread that was made from specially grown yeast in a laboratory was found to be ropy.

When yeast is faint in summer it is frequently so because of having "softened," that is, having commenced feeding upon itself or having commenced to undergo decomposition, and the water with which the softened yeast was washed was found to contain a gummy matter and an uncrystallisable syrupy substance. As ropiness sometimes does not develop until a day or two after baking, much bread is eaten with a full force of germs in it, but they are quite harmless to the consumer, being similar in that respect to many other germs that are expressly cultivated. It is a well-known fact that certain germs are sown so as to counteract others. At one time some used to talk of the freedom of yeast from bacteria as a criterion of its commercial value; that may be so in some cases, but certain yeast manufacturers put acid germs into it in order to check subsequent development.

Lactic acid germs are recommended by authorities on the Continent, where the leaven process is used, for checking rope. This may have some small bearing on the freedom of Scotch bread from rope, although, of course, there are more important factors in that case; for instance, although the Scotch process is long and slow, it is really a very powerful and well-conducted fermentation. There is an immense amount of yeast grown throughout its long process, and although steady, the fermentation is very different to the differently handled, starved and half-dead doughs that favour rope; it is like the slow working hydraulic ram, which has great force and cannot be easily checked. The fermentation is so complete that everything in the way of gummy matter or a suitable nidus is eaten up and dried out. There is, moreover, the great bulk, and further the very perfect aeration of the Scotch loaf, and a long process being the rule every precaution is accustomed to be taken. It is not a slow fermentation in the sense of being a faint or a starved one; it is progressive all the time. The so-called native germ of cheese and butter, the one corresponding to the yeast of bread, is the lactic bacillus, and it has been found, and is done commercially, that the best way to prevent the effects of mouldy or rancid or tallowy flavour giving microbes, is to get rid of as many of the latter as possible, but being unable to get rid of all of them, a strong crop of lactic germs is grown in a "ferment" just like a baker's. This is then added to the bulk, so that the native or desirable germs so outnumber the undesirable ones as to arrest their action long enough to allow the cheese to ripen with the flavour as desired. This is an uncontroverted fact and is on all fours with what is required in the case of yeast in bread in order to keep down rope.

It is said that sunstroke is not due directly to the sun, and it is well known that some people can stand a blazing sun better than others, and themselves stand it better at some times than at others, according to their health, but the hot weather provides the conditions necessary for the development of the sunstroke organisms. It is the same with two people going into an infectious place, the one catching disease, the other not. The germs of many diseases are always in the air, but occasionally the conditions are more suitable for their development and powers of destruction than at others. When they increase in the air more people fall victims, and there is an epidemic, there are then extra precautions taken to decrease and prepare against them. It is the same again in the botanical world. Grains of wheat can lie on the table and elsewhere dormant for long periods. They are not dead, although inactive, but when they are placed in the warmth and moisture of the soil they fecundate.

It is therefore seen that in the study of ropy bread many principles are involved. When preparing to give a lecture on the subject we made a series of loaves in all the various ways that are said to cause the trouble but could not get a case of rope. It was in the autumn and the germs were evidently scarce, although cases have been known in the winter. For the past ten years or so we have never passed a summer without getting cases sent by correspondents whom we have never failed to relieve promptly.

In conclusion, then, there is seen to be really no one cause except the triumph of the ropy germ over the yeast or gas. When this serious disease asserts itself one must first take all precautions to decrease the germs by clean utensils and good materials as much as possible, and more particularly increase the vigour and maturity of the fermentation instead of checking it. It is necessary to get more gas, more ripeness, more lightness, thereby less stickiness and more dryness and more thorough baking, and then quick cooling.

HOLES IN BREAD

CONCERNING holes in bread there are many conflicting opinions. Men engaged daily in the handling of dough differ; thinking men who commit their thoughts to paper are diametrically opposed; but we think the differences of opinion would disappear if the different kinds of holes were kept in mind, and the subject more fully discussed. Holes in bread may be divided into two classes—those, on the one hand, which are more or less distributed in a loaf, being of medium size and numerous, and those, on the other hand, which are very large, being only one or at most two in the entire loaf. There are many subsidiary causes, which we shall proceed to discuss; but the first class of holes, as above, can usually be traced to inadequate fermentation, inadequate proving or inadequate recovery after pressure, at one or more of the various stages. Holes will be minimised or accelerated according to the suitability of the moulding to correspond with the different degrees of ripeness of the doughs. The second class of holes, as above, will be caused where there is too much fermentation, thereby too much degradation and collapsing of the gluten webbing, or to folding in skin or cones, or to pieces of unbroken sponge, or to severe bashing. Sour bread practically never contains the first class of holes, but occasionally, in the making-up, will possess one of the latter class.

Section of Champion Scottish Plain Loaf, London Exhibition.

(ACTUAL SIZE.)

We often find the use of a stronger flour than usual giving holes. We frequently hear it remarked by various bakers with whom we come into contact that they do not use So-and-So's flour because it makes holes. The holes are not the fault of the flour—the strongest flour can be used without holes; the fault lies in using that flour for that particular method of making bread; one is using a stronger flour than the style of fermentation requires, and to use strong flour when one has learnt to use weaker is pure waste. Extra strong flour, when of good quality, and not of a low, coarse nature, is expensive to buy, wants more breaking up, and is only required by the old school of bakers for special sorts of large, highly fermented, highly silky, and fine-textured bread, such as Scotch. If, then, you find the presence of a certain flour accompanied by holes, you might discontinue it as not necessary, or suitable to you; but the real cause of the holes in this case consists in the fermentation not being sufficient to mellow the flour, and extra fermentation, all things being equal, would disperse the holes, but, practically, it is easier to discard a flour than to alter one's process of fermentation and the time of one's work.

The inadequacy of fermentation could, of course, be corrected by more yeast, or more heat. Holes caused by insufficient fermentation usually occur more often in off-hand dough than with sponge and dough. Holes in off-hand dough often appear when the dough is only to be given—with normal quantities of yeast—about four hours to the oven, and has had a cut back to clear it at about two hours, which, of course, checks the fermentation in that instance. In that case more total time and more between making dough and cutting back is needed. In a sponge and dough process the holes, when present, are more usually—no definite statement covering contingencies can be made—not the result of insufficient fermentation in the earlier stages, but of insufficient proving on the boards after heavy kneading, or insufficient recovery after heavy moulding in the hands of a clumsy moulder. If fermentation has been slow and steady, loaves will be a long time recovering their spring.

After heavy and rough moulding, fermentation would be temporarily checked or subdued, the loaves would feel dead, and would not be evenly inflated if put into the oven before they had recovered from the pressure. If unevenly inflated there would, of course, be holes, because the unevenly distributed gas expands under the action of the oven heat, and, being unable to escape, keeps the dough distended unevenly until baked. If the dough is ripe, but sluggish, it should be moulded lightly, or holes will result if put directly from the moulder into oven. Fine, well-cleared bread of good even texture is not obtained without plenty of labour, and the labour must be well backed up by plenty of tissue or gluten in the flour, and plenty of salt to toughen this tissue; but where labour has been given, and the dough is ripe, there has been plenty of time allowed for the dough to recover, and the extra time has often destroyed the flavour of the flour, which then needs replacing by salt. We therefore usually find the counterpart, namely, that bread of rather coarse, rough texture, merging into distributed holes, retains the flavour of the flour, and is sweet. But if this labour, which, under some conditions, contributes to pile, be applied at the moulding stage of ripe or over-ripe or sluggish dough, and the dough almost immediately baked, we lose the good texture characteristic of highly fermented bread, getting the holes without the sweetness. As to whether the holes are the result of unmellowed and inelastic tissues, or the result of over-weakened tissue, the network breaking down from small interstices into holes like the overweighted net of a fisherman, as to which of these states produces the result, can be ascertained by the nose.

At one of the early Agricultural Hall Exhibitions we remember seeing a loaf that took third prize, and would easily have taken first except for a large hole just in the centre of the bottom of the cottage. This loaf had been made from ferment, sponge, and dough with brewers' yeast. It was matured to perfection; it was not green, nevertheless perfectly sweet; it having had a long, steady, fermentation, was not generating gas quickly; was not baked in hot oven, which, under these conditions, would have pulled and distorted it considerably; it was suitably moulded, but, nevertheless, the hole was there, and could be clearly traced to the excessive bashing. Two fingers had been pushed right down, and the compression was so great—it being traced right to the sole of the loaf—that, even with a rapidly recovering dough, some time would have been required for the rebound, whereas, in this case, we learnt that the ovensman had taken it straight from the hands of the basher. Even with a medium oven the dough was bound to fly, or give somewhere, because the heavily compressed part would be temporarily numbed or subdued, and the gas pressed out of it so as not to expand evenly with the rest of the loaf when thus invited by the heat of oven gripping the head. The hotter the oven, and more sudden the grip, the larger would be the hole when the dough was unprepared to respond to it.

A piece of well-wrought dough allowed to expand at its own pace, say, on the boards, and unstimulated by heat of oven, will show no holes on being cut; it does not rise until it is ready to, and whether under-fermented or over-fermented, there is no considerable expansion of gas to test or strain the inelastic tissue on the one hand, or the rotten tissue on the other. On the same lines, holes in a Coburg (this not being exposed to the oven on so many surfaces as a cottage, or not being subjected to the uneven pressure of bashing, or to the possibly uneven pressure caused by moulding the different sized parts of cottage in two hands, or by occasionally placing Coburgs to prove in boxes or drawers, and leaving cottages out), are less usual than in cottages. By thus thinking of examples for ourselves we learn the causes of holes better than by letting others do all the thinking for us, and giving conclusions in a manner that often convey the opposite of that intended.

In some cases we have found the introduction of kneading machinery aggravate holes. This, of course, is not the fault of the engineer. The fault is on all fours with the same thing that occurs when dough is not in a proper state to be put into the oven direct from the hands of a heavy moulder. Tightening up in a machine is the excess of moulding, and when thus deadened, and not allowed to recover, it will not respond as pliably as it should when being raised by the oven, the same as with too severe bashing: it must have time. In one of these cases, instead of extra time, we recommended that the dough should be kneaded to a greater extent by the "reverse" motion of the machine. In that case the kneading takes longer, but it is more lightly done, and the holes disappeared.

If the sponge is tight the fermentation would not be so far advanced in the same time as when slack, that is to say, if the amount of flour were the same in each case, and only the water altered. Pieces of unbroken sponge would be undistributed gluten. A piece of gluten thus separated from the flour expands under the influence of heat from the size of a walnut to that of an apple, lifting the dough unevenly into a hole. When a skin is carelessly turned in there will, of course, be smooth, dull holes, as two skins will not readily adhere to one another, and the least pressure of gas must part the two into a hole. We well remember an Irish loaf sent us, made from well-wrought dough, but much rolled up, and the huge hole therein was entirely the result of two skins in the interior not adhering.

We once received two cottage loaves made in same way and from the same ingredients; one cut well, with a good face throughout, and the other had an exceptionally large hole in the bottom, and was also holey in the top. There was no sponge, therefore the hole was not caused by unbroken sponge; and as the flour was the same in each case, it was not caused by strong or weak flour. It was well made and well cleared, as it was made in a machine; and the crust was beautifully smooth, well finished, being moulded quite green, without any cones whatever; and the whole loaf from the exterior had the appearance of being turned out by a thoroughly good workman. Both loaves might be said to have been made under best conditions, and none of the usually mentioned faults of holes were present. It might seem strange that one loaf was so much worse in that respect than the other, but, carefully looking at the matter, the fault was evidently due to the moulder; although the moulder might be looked upon by his fellow workmen as a good one, he was, however, not a good one in the respect that he had moulded the loaf in a manner unsuitable to that particular dough. He had moulded too heavily, and therefore tightened up too much a dough that was already tight. His moulding would not have been too heavy, and would not have had such disastrous effects, if the dough had been slacker, had been free either by reason of more yeast or more heat, or if the loaf, when moulded, had been allowed to stand longer, or had been set in a cooler oven. But in the particular circumstances of that man's trade the extra time was not convenient, nor was a cooler oven, all things being correct, to be recommended; therefore it was the moulder's fault in moulding dough in such a manner that it could not recover itself under the conditions with which he had to work. The fault was not that he was a bad moulder in the ordinary sense of the term, but that he did not suit himself to the conditions surrounding him. The man that moulded the loaf that was without the hole had adapted himself to those conditions. In other words, one man knew he had a tight dough, and that there was not much time for it to recover after moulding, and that it had to go into a hot oven, and he therefore moulded it lightly and made a big head for it, whereby the tightness of the dough and the conditions that were to follow were largely compensated. His lighter moulding and the larger head he made did not make such a pretty loaf to look at outside; it did not stand up so well, but what it lost in exterior appearances it more than gained by having a better and more even interior. Had the dough been made slacker, or had there been plenty of time after moulding, or had there been a cold oven, then the man that moulded lightly and with a larger top would not so easily have made a better loaf.

Many loaves are perfected or marred by the handling they receive after the dough leaves the trough, and, although the moulder might often blame the proving, or oven, it is he that should adapt himself to the oven, rather than expect the oven to be adapted to him. Although there are thus to be seen many subsidiary causes for holes in bread, the great majority are, undoubtedly, caused by too much hurrying at the finishing stages, that is, too little proof after the loaf has been moulded into its final shape. Proving on the boards, or at any previous stage, has no desirable effect if the proof is again knocked out by the moulding, or docking, and not allowed to recover; but the better dividing of the time for proof need not necessarily mean more total time, or thus delay the batch. When the holes are caused by dry skin, or by excess of cones, the latter can usually be seen, especially with a glass, sticking to the surface of the hole. It sometimes happens in short methods that dough has not an even consistency throughout, it having been hurriedly made, and not having sufficient time for the water, and even some of the ingredients, to be evenly distributed throughout the whole.

Sometimes lumps of yeast or salt will cause a hole; therefore the liquor in which these have been dissolved, and also for other reasons, should always be strained. The holes that are made by excess of cones or skin on the surface, or by abruptly finishing closings, are usually of an acute and smooth kind; whereas the holes from immaturity of fermentation are usually of a dragging kind, that is, there are fibres stretching from them. These dragging holes are very often seen, and are of oblong shape, in a tin loaf that has been made from a very lively dough, and placed in a tin too small for it, whereby it is not proved long enough, and, when put into the oven, the gas rushes suddenly from the bottom to the top. Where the dough is not well cleared there will be gas bladders that ought to have been squeezed out, and which will expand into holes when coming under the influence of the oven. In this case firmer moulding would benefit, but the firmer the moulding the longer must be the time for recovery.

There are some cases, however, in which over proof in the case of tin loaves, especially in brown breads, will make what in this case, however, should almost be called cavities, being so distinctly different from the majority of so-called holes. The cavity referred to is that which happens when the loaf has been proved and risen to a greater extent than the flour would properly stand. The crumb then, before it becomes set by the heat of the oven, somewhat falls again, but the crust has by that time become set, and does not fall with it, the two therefore parting and leaving a cavity. Excessive water in the brown bread often helps to this result. Tin bread, however, as a rule, contains less holes than other sorts, because not only is it often slacker and more pliable, but also, in other cases, is usually moulded and placed into the tins first, and yet set after the other loaves, thereby getting greater proof. Sometimes the top crust of the loaf has been blown up from the remainder like a balloon, simply because there is a skin all round the exterior, and the bash hole was incomplete or sometimes stopped up by a prepared wash, whereby the gas could not escape and had to lift the whole crust. In this connection it might be remarked that, although immaturity is often the cause of holes, it is possible for a loaf to be excessively young and have no holes, simply because it has very little gas. Big heads on cottages sometimes decrease holes, but, on the other hand, if not set under conditions whereby the loaf keeps its shape, but, on the contrary, falls over largely, the falling and pulling over will make holes of its own type, and excessive top heat will often add to these. In the case of headless bottoms, however, there are not often large holes, the size depending on the speed at which the top leaves, because when the head is off the force is relaxed. If the closings of cottages are put upwards instead of on the sole, when the latter is very hot, a hole will often be saved. In the Scotch system cases of holes by insufficiently broken sponges and use of hard flours in the dough are more general, especially when sponges are unripe. It is thus seen that each defective loaf is a law unto itself, there being very few things that could be called, in all cases, absolute causes of holes, the effect always being in proportion to many other conditions.

BLISTERS AND BLADDERS

THESE imperfections are caused chiefly by the dough being under-ripe or under-proved. Uneven moulding, or a blow or knock, will often be the direct cause of the top layer leaving the next to it, and therefore making a blister, but these instances can be largely minimised by more proof. Various causes have been given for the presence of these imperfections, but when analysed they all amount to the same thing, namely, immaturity, at any rate more maturity would get rid of them. They are said to be caused by very cold sponge or dough, but it is obvious that such a sponge would be more ripe if warmer. They are sometimes ascribed to strong flour, but such flour would be more mellow if the fermentation was more ripe. The same applies when they are said to be caused by undegraded gluten. When the dough is particularly lively and wiry these blisters sometimes appear, and would be cured by the dough being again knocked down and given another half hour before throwing out. Extra slackness in the dough and more proof will usually stop these, but cases have come under notice where the correspondent has said he got the blisters with a slack dough and well-proved loaf; on further inquiry it was found that these blisters were in the loaves that were set just round the furnace, and not in those that were set elsewhere. This may be ascribed to the excess of heat, but it was merely that, of course, the loaf should have had more proof when going into a hotter place; it was merely insufficient proof for the extra heat rather than the direct result of the heat itself. In the same way heat can be toned down by a blanket of steam, and the effect of undesirable moulding be minimised by better conditions of recovery therefrom.

ENGLISH CHAMPION COTTAGE

SECTION III

CHANGES IN FLOUR AND BREAD DURING STORAGE, FERMENTATION, BAKING, AND DIGESTION

"—A drop of Ink,
Falling like dew upon a thought,
May make thousands think."

BYRON.

CHANGES IN FLOUR DURING STORAGE

IT is a popular opinion that age in flour improves its quality. This up to a certain point is true, but in the same respect that age will have more effect and a different effect on persons according to their constitution and stability, so will age have a varying effect on flour.

Flour improves in most respects by being kept for a period of about two months, but as time advances there will be a deteriorating action according to the quality, condition, and character of the flour, and also according to the conditions of its storage. The improvements will be in the respect of the flour working drier, but the deterioration will be chiefly in the flavour, which will, as a rule, evaporate somewhat in the same degree as the water and often change in other respects.

The best conditions under which flour should be kept are in a store of from 70 to 80 degs. with, if possible, opportunity for the evaporating moisture to get quite away. In this respect the space given by some people for the purpose of allowing a cat to get round the sacks to keep away the mice, is useful for allowing moisture to evaporate. Evaporation of the moisture will be in proportion to the heat of the store ; and there is found usually to be a considerable decrease of moisture in hot places in a short time, and also a considerable amount under usual bakehouse conditions in three or six months. Curiously, more water seems to be lost than can be proved to have evaporated, that is, there seems to be a certain proportion lost that cannot be accounted for by the ordinary methods of testing moisture in flour ; and it seems this difference is accounted for by a certain portion combining with the gluten. This combining of the water with the gluten of the flour with age, is borne out by the fact that more gluten can be extracted from old flour than from the same flour when new, the percentage being increased by less of the gliadin becoming soluble in old flour during extraction by washing.

It is sometimes found that flour milled from American wheats in this country contains less gluten than the American flour from the same wheat, the difference being accounted for by the difference in age and dampness, which difference becomes adjusted with keeping and drying. In stone mills it was the common practice to let flour run into "a pastry," namely, the large room in which the flour was stored in bulk before being put into sacks, whereas now it is practically always run direct into the sack. It was contended that this was an improvement to the flour, and it was sometimes contended that even storing the meal after it was ground, but before it was refined to finished flour, allowing even some weeks to intervene, was also an improvement. The germ of wheat contains relatively large amounts of nucleic acid, and some 3 per cent. of the total acid is contained in freshly ground commercial flour, but it rapidly lessens on the flour becoming older.

As flour was formerly of a much softer and damper character than now, owing to the nature of the wheat ground, more precaution had to be taken, because soft flours improve most with slight age, but when badly stored, deteriorate first. If flour is stored in a cool place, which might be defined as being from 45 to 55 degs. F., evaporation is very slight, and although evaporation is great when in warm places, say, from 80 to 90 degs., it is found that the whole of the evaporated moisture, and oftentimes a little more, will be reabsorbed when the flour is made into dough. In the case of soft and moist flours in which the changes are always most, deterioration will often set in after two months, especially if not kept in a dry place, but in cases where one flour would deteriorate, another would improve by standing a further time, and the time in all instances must depend largely on the quality and condition of the flour itself.

In the matter of colour the flour will be found during the first few weeks to bleach, but, if damp and kept in a damp cold place, it will not be very long before it commences to darken or undergo other changes. Stronger flour will continue to bleach for a longer period, say, up to about three months, and will run less risk of deterioration, but at the same time all flour will lose in flavour what it may gain in colour and dryness, and can be kept until it is not only of bad flavour but undesirable in other respects.

We have just turned up a note that we remember making some years ago when reading the scientific papers that are published in France under the name of "Comptes Rendues," which is to the effect that alkaloids are formed in flour when kept more than a year; two to three-year-old flour killed sparrows fed upon it in a few hours, with all symptoms of poisoning —formation of these alkaloids attributed to gradual conversion of gluten under influence of a ferment existing in the original grain.

Flour that becomes overheated is much deteriorated for bread-making, for instance, if it should be heated in a hot water oven at merely a temperature of 212 degs. F., as is the case when flours are tested for moisture percentage, whereby all the moisture is driven off, it will then be found useless for bread-making, refusing, like sand, to amalgamate. If heated, say, to 160 degs., the effect will not be so great, but still would be affected by reason of some of the ferments being killed or weakened; if heated to 120 degs. there will be practically no injurious effect.

It is within the author's personal experience, that the difference that takes place from allowing wheats to lie together from Saturday to Monday can be recorded by figures. It has been found repeatedly, that where percentages of flour produced from wheat were taken, that the percentage on the Monday was greater than on the Saturday, there being no difference except that the wheats had been lying together on the Sunday, namely, for more time than at any other part of the week. This, perhaps, had better be dealt with when referring to blending. There is a popular idea that the life of wheat is practically inexhaustible by age, being held by some that the mummy wheat is still capable of growing. But it is well known that much wheat taken from mummies has been put there by modern hands, and it is somewhat interesting in this connection to remark that maize was recently taken from a mummy, yet in the days of the ancient Egyptians this cereal was not locally grown. Wheat, by keeping, will continue to improve for a longer period than flour, and will not deteriorate so quickly by keeping too long, but, of course, here, as in the case of flour, the changes depend on the condition of the wheat itself and on its storage.

CHANGES DURING FERMENTATION AND BAKING

THE ordinary changes that take place during alcoholic fermentation consist of the yeast acting on the flour, or other foods, producing the final products of alcohol and carbonic acid gas in about equal weights, and also traces of succinic acid and glycerin. Yeast by itself is not strong enough to start fermentation with perfectly good sound starch of flour, yet it must have some of this starch as food in order to produce the sugars, maltose and glucose, which are the intermediate stages in the process of changes between starch and gas. Yeast starts on the natural sugar already present in the flour, and softens the albuminoids or proteids, changing the latter into peptones. These, in conjunction with the digesting agents in the yeast, acquire power to break down the weaker or fissured starch cells. However carefully the flour may be ground there will always be some broken cells which, by being broken, allow ready access to the yeast, and the larger the cells the more quickly they are broken. The starch is changed, according to heat employed, into about four parts of maltose, which is a sugar directly fermentable by yeast, and one part of dextrine, which is a gummy and sticky moisture-retaining substance, quite unavailable to the yeast unless further changed. The maltose undergoes further change into glucose, a lower type of sugar, and then into gas.

The changes would be no different when the dough fretted ; they would merely be quicker, more of the constituents would be broken down because of the heat generated, and the normal gentle softening of the gluten, as required, would be greater. If the yeast fretted in a ferment, it would probably get exhausted and not reproduce itself in a normal manner, and, although the fretting would of itself make no different products, there would, in the case of the yeast being exhausted, be the opportunity for other organisms that are always present to commence their work and changes.

An important lesson which, according to his note book, the author conducted for a pupil on a Bank Holiday some years ago, and which will teach much of value in connection with the daily routine of commercial batches, can be obtained by making a dough and cutting off from it portions at intervals, of, say, an hour, and then moulding and baking in the usual way. The first point noticed will be the great difference in the feel of the dough at its various stages ; on the one hand when under-ripe, it will be resisting and tough, and on the other, it will be yielding, squeezable, and short. When baked there will be easily seen a much wider difference between the various loaves made from the pieces cut off the main bulk of dough at the different periods. At first the crust is foxy, then with good bloom, then pale. Crumb gets whiter, brighter, more bloomy, then grey, dull, and dark. Loaf is sweet but raw, then tasteless, then sour, then putrid. First dry, then moist, dry again, then clammy, being difficult to bake. The details vary in detail according to other details.

If a small portion of each piece of the dough cut off at the various periods is washed for the purpose of ascertaining the quantity of gluten therein, it will be found that at the first hour more gluten can be extracted than if tested immediately on making the dough, but as time proceeds the amount will gradually become less, and from over-ripe dough it is impossible to extract any whatever. What might be present is so changed in character that it is not adhesive, not sticking together in the customary tough and elastic lump, but passing away with the starch and water, having been changed by the fermentation from its proteid form into more soluble peptones. Inasmuch as yeast is largely made up of nitrogen, and must have therefore nitrogen during growth, and is unable to feed on the proteids until it has changed them to peptones, it probably has resource to the latter for its healthy nourishment.

The chief differences between the bread that is raised by the gas formed by yeast, and bread that is raised by the same gas being pumped into it artificially, or supplied by the action of chemicals, are due to those changes of the gluten and the starch. It is the yeast that digests them in much the same manner as in the human body. It is difficult, therefore, to see how certain breads that are raised by artificially added gas can be more digestible, as is claimed, or foods so digestible as the fermented loaves, but they, of course, contain no acid. The differences in volume, moisture, colour, flavour, and texture are considered under their respective headings.

The changes during the baking are also very great, inasmuch as the baking converts an uneatable mass into a wholesome food. The heat stops one series of changes, namely, those of fermentation, and then, further, at a temperature of 148 to 153 degs. F. causes the starch cells to burst; they are then amenable to the digestive action of the natural ferments in the flour or any similar substance, such as diastase of malt. As the heat increases to a temperature of 180 degs. these albuminoids and ferments, such as diastase, are rendered inactive by being thickened or coagulated in exactly the same way as the white of an egg becomes set by boiling. The heat renders the loaf light by expanding the gases therein and driving off much of the moisture and other volatile substances, such as alcohol. As this latter substance boils at a temperature of about 198 degs. F., there is usually in fresh bread only about ¼ per cent., and the amount driven off is not of such considerable account as sometimes supposed. Many attempts that have been made to collect this alcohol for commercial uses have been doomed to failure. The heat, according to its intensity, dextrinises or caramelises the crust, and when the loaf is well baked an average analysis of bread, as usually found to-day, can, without going into decimals, be fairly well set out as follows :—

Proteids or nitrogenous matters . .	7 per cent.
Sugar (maltose, glucose, etc.) .	2 ,,
Fatty substances (barely) . . .	1 ,,
Cellulose or woody fibre (barely) . .	1 ,,
Ash or mineral matter . . .	1 ,,
Carbohydrates (starch, dextrin, etc.) .	48 ,,
Water	40 ,,
	100 per cent.

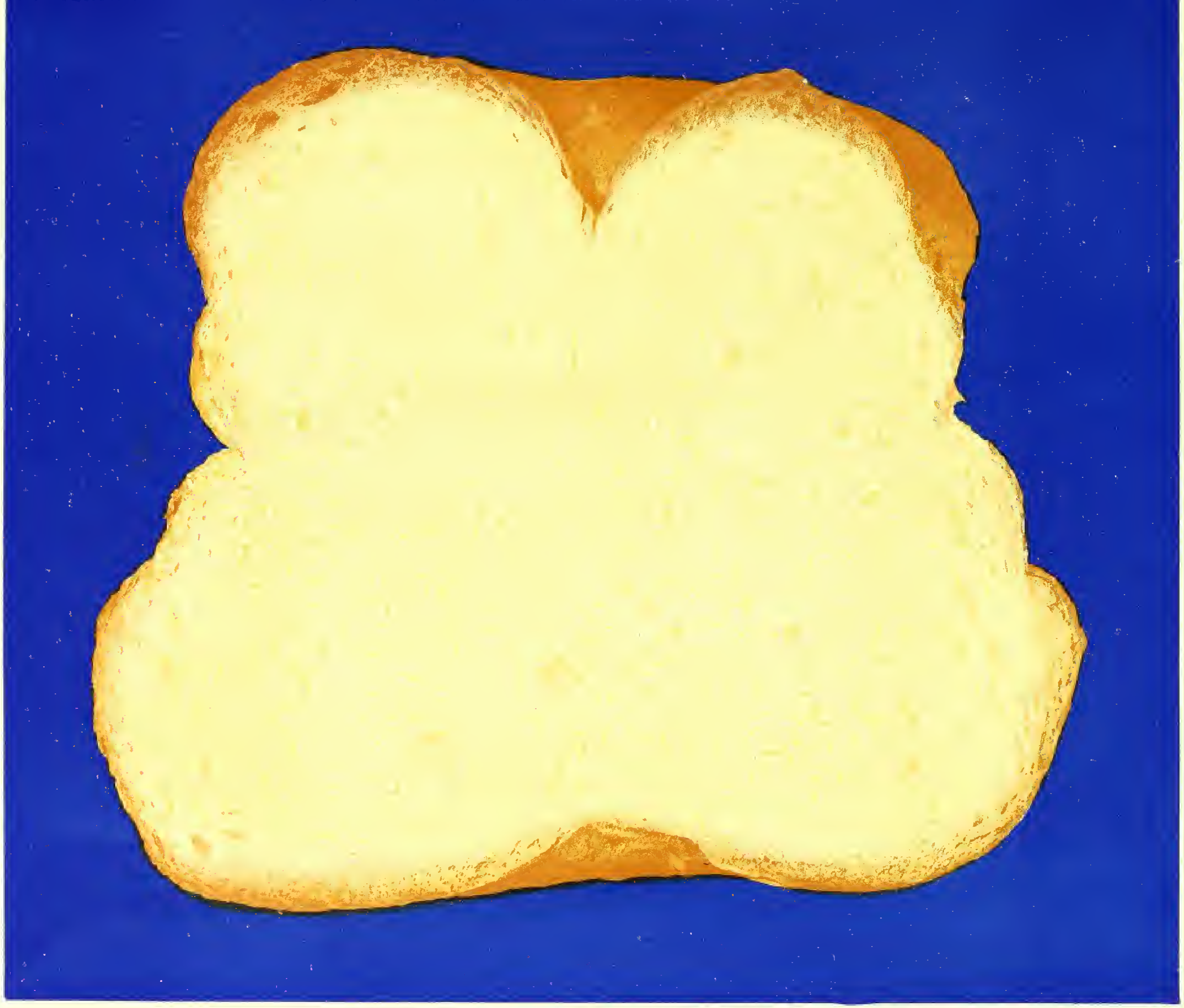
Although there are variations, the latter are not great with bread made of good average flour.

CHANGES DURING DIGESTION OF BREAD

THIS is the epoch when many various special and patent breads or other special substances are offered to the baker for his adoption, and also when the public, especially a certain portion, are much interested in the digestibility of various breads. An intelligent grasp therefore of the subject by the baker will often serve to make or keep a good customer, and often enlist the interest and support of the local doctor who is a traveller to many of the best families. It will therefore be interesting and also commercially useful to explain to some extent our human digestive apparatus, which many persons wrongfully—especially bakers, who are largely custodians of the public stomach—neglect to study.

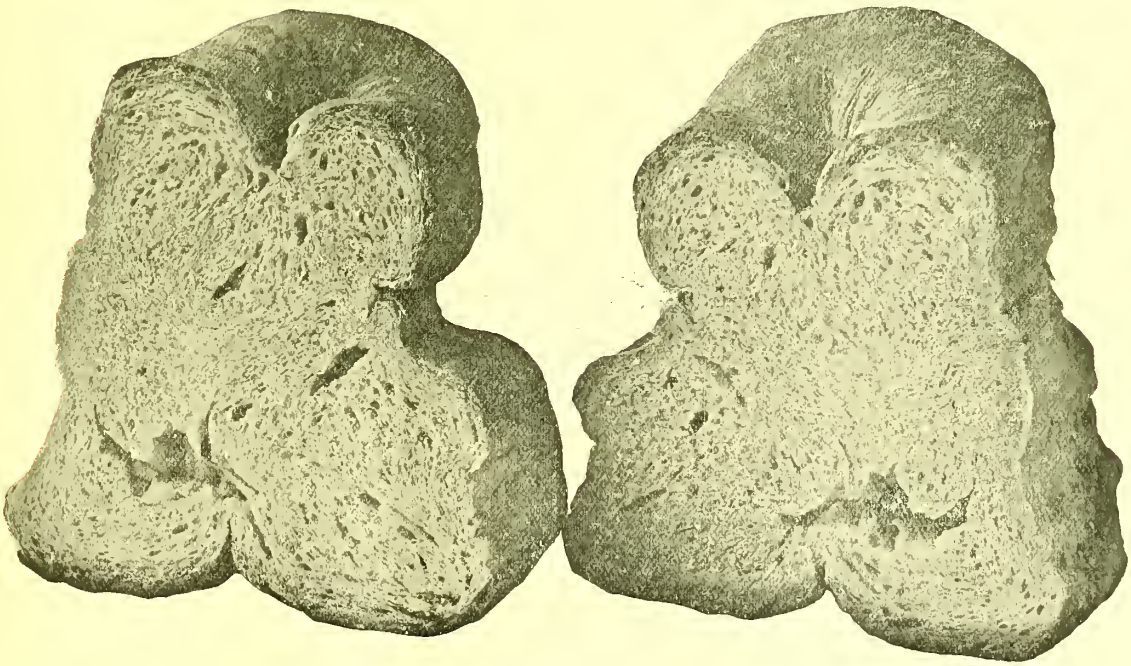
Our digestive apparatus consists of a so-called alimentary canal, with various organs accessory to it. It is a muscular tube of no less than 30 feet in length, or five times as long as a tall man, extending from the mouth, and, of course, ending at the anus and rectum. To six different parts of it are given different names, viz. mouth, windpipe (pharynx), gullet (œsophagus), stomach, small and large intestines. The accessory organs are the teeth, which masticate; the glands, composed of cells, which secrete the various digestive ferments; the liver and sweet-bread (pancreas), which also respectively pour out their bile and so-called pancreatic juice. When the bread or food is being properly masticated, it, of course, becomes mixed with the saliva, which is caused, by the contact of the food, to flow from the three pairs of glands in which it is secreted. All of these pairs of glands have different characteristics, but it will suffice to say here that the saliva flowing from them consists, when mixed, of over 99 per cent. of water, and of an important digestive ferment called ptyalin. This ptyalin, like the ferment diastase, converts the starch of the bread into probably two varieties of maltose and three of dextrin. It is obvious that the easier the bread can be masticated, and thus brought into contact with the saliva, the better will it be digested. This well shows the ignorance of some people when they say a heavy bread "satisfies." An indigestible substance may feel heavy and filling, such as a lump of clay does to the camel rider when without food in the desert; but, if indigestible, it cannot possibly be nutritious, or any good as food. This ends one important stage.

When masticated, our bread or food is forced by the tongue back to the palate, thence, by the united action of the tongue and windpipe muscles, finds its way to the gullet, thence to the stomach. The stomach consists of a pouch divided into two parts, large and small, and possesses three coats. Into the well-known depressions formed by the mucous membrane (the inner lining, composed of a web with numerous fibres), and



SECTION OF ENGLISH CHAMPION COTTAGE

called the "pits of the stomach," a host of glands empty their secretions. Near the lower end these glands secrete mucus, but elsewhere they secrete the important colourless fluid, with a sour taste, known as the gastric juice. This gastric juice, although being composed of more than 99 per cent. of water, contains phosphates, chlorides, some free acid, and another important ferment known as pepsine. This pepsine is the chief juice of the



HOW NOT TO DO IT!

stomach. Although dissolving the tissues that hold meats together and setting free fat, it has, by reason of the acid contained in the gastric juice, no effect whatever on any starchy substances, and even stops the action already set up by the ptyalin of the saliva. The bread, on entering the stomach, goes first into the small pouch, thence into the large, and thence slowly journeys round the stomach, coming again to the place of starting, until it is rendered able to pass into the small intestine. The pepsine, as contained in gastric juice, although not acting on the starch, dissolves the gluten and albumen, converting them from proteids (insoluble substances) into peptones (soluble substances), and produces material to be absorbed by the above-mentioned glands.

At the conclusion of these various changes—during which, throughout the whole day, no less than 14 pints of gastric juice are secreted, the starch at last passes to the small intestine in almost the same state of digestion as it entered the stomach. The small intestine is about 15 to 20 feet long and $1\frac{1}{4}$ inches in diameter, and is divided into three parts, with the names of which we need not trouble. Throughout the small and large intestines are so-called tubules, or small pipes; these, together with the glands, secrete so-called intestinal juice. This juice, together with the bile from the liver and the pancreatic juice, completes the digestion of the starch of the bread, concerning which the gastric juice was incompetent. After wending its way through this small zigzag intestine, the bulk of the food should be now practically digested, the remainder passing into the large intestine (which almost completely encircles the smaller one), and there having the remaining nutriment extracted as much as possible before excretion as waste.

By reason, therefore, of the digestibility of bread by the juices of the mouth, its indigestibility in the stomach, and on account of its requiring through all stages more time to digest than meat, we can easily understand how its thorough mastication is of the utmost importance. Its particles thereby become sufficiently finely divided, so as to come in contact with the digestive juices, instead of being swallowed in a lump, whereby its slower dissolution afterwards gives the sensation of heaviness. New bread is chemically almost as easily digested as stale, and it is only on account of its greater tendency with insufficient mastication to bind up thus into a ball, instead of breaking into finer particles, as it does when drier, that causes it to be called indigestible. In the same way wholemeal bread may be correctly said to possess more nutriment than finer white, but it is not more nutritious to the consumer. In the first place, wholemeal bread is usually heavier and closer, and, in the second place, the greater coarseness of its particles irritates the intestinal tract, as can be easily understood from the above description, whereby it not only passes from the body before being completely deprived of its nutritive properties, but also carries with it at the same time other foods less perfectly assimilated. This has been conclusively proved by actual experiments. Wholemeal or brown bread is therefore a useful medicine for the overfed or the constipated, and more sedentary brain worker, and is not the panacea for all the troubles of the working man or rickety children. Nature usually selects its foods wisely, and it is an undoubted fact that more wholemeal bread is consumed by the professional classes than by those labouring physically.

The popular idea, however, is that wholemeal bread has many properties which it has not, and if bakers were to give more attention to it as discussed by us in Sections IV. and VI., the sale would undoubtedly increase. Not only is it good for piles and constipation, but some medical men, and dentists, and authorities contend that it arrests decay of teeth. It is contended that women often have caries of the teeth, because, when enceinte, the fœtus or infant needs phosphoric acid, as contained in wholemeal, for forming bone; and, in corroboration of this, it is found that phosphoric acid is absent from the urine for most of the pregnancy time.

The brown meals are practically white flour plus the husk or brown covering of the grain, which is the bran, but one does not give bran to the lower animals to nourish them; one would not expect so much work out of a horse, by feeding on bran mash continually instead of corn, yet the digestive or diastasic ferment in such is stronger than in human animals, and some recent experiments put the pig in the forefront in such matters, followed in order by the rat, rabbit, ox, sheep, and cat.

The digestion of various foods depends and varies according to the consumer and his work, and the amount of food taken; and the same food is not, even by the same person, always digested to the same extent or so comfortably taken. As a rule, however, according to the state of health or exercise of the consumer, the finer the particles of the same substance, the easier the digestion, but although patent or high grade flour is usually finer than lower grades, the difference is not usually sufficient to be noticeable from the standpoint of digestibility. Where, however, the difference in fineness and coarseness in the dressing is so great as to admit offal in the one case, there is, of course, a difference. The meal made from the whole grain, has been found less digestible than when the outer of the several skins was removed; and when only some of the bran was removed the flour was less digestible than when entirely removed, also the whole wheat when ground up finely, although of same constituents, was more digestible than when left coarser.

The husk of the wheat certainly contains some valuable salts, and there are some inventions on the market for extracting these and presenting them in a digestible condition; those of the germ, although on the exterior of the grain at one end, are easily digested. Rye flour is less digestible than wheaten flour, and barley and oats still less so. Bread is, on the whole, rendered more digestible by toasting, but the protein matter in it becomes less so, in the same way that gluten when dried is horny and hard. Alcohol retards the action of the saliva on starch, and tea much more so, and wines have a similar effect. In the latter case the result is due rather to the acids of the wine than the alcohol. On the other hand water, especially when warm, much helps the action. The above will help one to understand to some extent (1) the changes during bread-making, (2) malting, (3) scalding, and (4) fermentation, which will be found discussed elsewhere.

SECTION IV

THE FINISHING OF THE DOUGH

" He who knows his incapacity, knows something."

MARGUERITE DE VALOIS.

THE SHAPE AND FINISH OF LOAVES

ALTHOUGH bread is made primarily to eat, the shape of the loaves is of considerable commercial importance. A good or symmetrical shape shows proper judgment during manufacture, and although there may be some eccentric customers who like an eccentric shape, one usually finds in practice that the distorted and ugly loaves are those that are left on hand. The small master baker picks out the best shaped ones for his window; the vanman of the larger bakery grumbles at everybody, and is indignant if the bread does not suit his eye, and wonders into where the lop-sided ones should be put; and the latter, although usually shorter in weight, are the ones that are cut up where bread is sold over the counter. The shape affects not only the appearance but also the niceness of the slice. It affects the value in the same way as does the shape or cut of a garment. The main use of an overcoat is to keep in the warmth of the body, but according to the finish of it, the same quality of cloth can be obtained at two different prices; or, on the other hand, the better finished one would sell much better at the same price. A nicely shaped loaf on the table also panders to the eye and invites acquaintance, or if cut up beforehand the thrifty housewife usually notices that a badly shaped loaf has more cavities for butter, is more difficult to cut, and also, particularly in the case of a pulled over tin loaf, makes more awkward slices, frequently leading to waste

At any rate the author gets a very considerable amount of correspondence from bakers thus troubled.

When crusty cottages are distorted and of ugly shape, it is because the heat of the oven has baked them too suddenly when they were not in a state to respond to it evenly. The same amount of heat in oven will not always have the same effect on loaves, the same as the same amount of heat in many other circumstances of daily life will not have the same effect. One of the many instances is the heat of a lamp cracking the lamp-glass, because, after being lighted half an hour, the glass will be much hotter than in the first few minutes, yet it is in the first few minutes that the break usually occurs. The glass is not in a condition to expand evenly, the heat catching and expanding the exterior too much out of proportion to the interior.

The two things that account for ugly bread are, in further explanation of the above-mentioned reason, firstly, too little proof after moulding. The gas having too little time to evenly distribute itself and evenly ærate the whole loaf (having been bottled up or confined and squeezed into smaller compass by the moulding in some parts of the loaf more than in others) must, when expansion commences, burst itself out somewhere, and suddenly, and thus throw the loaf out of shape. If, on the other hand, time were allowed, the loaf would have recovered from the pressure that stunned it, and, with the gas evenly distributed, would rise all over alike, and not in some places more than others. And, secondly, the other cause is too little steam in the oven to temper the heat that first plays on the loaf, or, what would be the same thing, too hot an oven. When there are quartern loaves, these, being bigger and higher, would, of course, catch the heat and suffer most. If loaves were closely set, they, by being protected more from heat of oven, would be pulled over less. If set crusty they must have fairly even distances round them at all points, otherwise the heat would attack them more on one side than the other, and pull unevenly. More proof after moulding, more steam, or else a cooler oven is usually the cure. Moulding less firmly would allow quicker proof, but would not be best for all-round results. Machine-made doughs require plenty of time to prove, and an oven with an iron sole is, of course, more rash than one of brick. Drawplates ought to help shape, because the loaves can be so much more easily set and evenly distanced, and are of great help in many ways.

Shape, however, depends more on the condition of the dough than on anything else, that is, the degree of proof in it when coming in contact with the heat of the oven. Putting on the drawplate does not take so long as setting with the peel, it is therefore more than likely that in the case of the drawplate the loaves have had less proof, and are worse entirely on that account. All things being equal, the loaves on a drawplate are more inclined to run flat than to be pulled over. As, however, all the loaves go in together the oven can be filled with steam when the plate is out, and the loaves going into it be thus protected from the rash heat. Loaves are often of better shape one day than another; one can therefore correct oneself and prove the truth of the above by closely watching the varying conditions, because the same series of causes will always have the same effect. All straight-off doughs are not, of course, the same. It may be taken as a certainty that if the dough is ripe before throwing out (and a ripe sponge will not altogether compensate for unripeness afterwards), and given proper proof after moulding, it will be of good shape if baked in an oven with moderate heat and regular spaces. Further, however, if the loaf proves slowly, provided it does so sufficiently, after moulding, it will be less ugly and keep better the shape into which it was moulded than if it proved quickly. Of course, it must not be forgotten that, if proving slowly, more time must be given in order to allow this sufficiency, as it is the insufficiency that is the chief cause of bad shape.

To go more into details, one might say, get dough ripe (it must not squeak when squeezed), scale, hand up, cover up with cloths, giving proof, hand up again, cover up and prove again, then mould and top and bash and put into boxes for thirty, forty, and even sixty minutes if the dough should be very tight, then carry boxes or drawers to oven mouth and set gently, just straightening loaves and not bashing unless it be gently with one finger. As regards shape alone, it would be better to have dough tight; it would then prove slowly, as referred to above, although having the same amount of yeast life behind it as before. If giving it two hours from throwing out until setting, it could, when throwing out of trough, be put back into machine for a few turns, and tightened up there rather than made too tight at first. If tight, it must not be hurried after throwing out, but must recover at each stage, or it will be pinched and unproven, and as bad as before. Tightness is not to be recommended as a rule, simply because the loaf then requires more time, which it does not usually get.

Sometimes a dough, by following a long cold and lifeless sponge, is exceedingly sluggish and proves so slowly that it is set into oven practically without proof, and the loaves can then be pulled even in a much cooler oven than otherwise, particularly if set at unequal distances, as one side of the loaf will grow much more than the other. Sometimes, also, a dough that follows a large and free sponge will be rushed into the oven and the loaves will lose their heads. If the sponge was smaller and less free, and the loaves under proved after moulding and put into hot oven, the heads may not always come off, as the loaf when set crusty all round in a hot oven sometimes becomes immediately fixed in shape and pinched by the heat; but if the same loaf be set more crusty one side than the other, only the one side becomes fixed in shape. The interior of loaf, which is not cooked as soon as the exterior, gets heated and wants to swell, pushing itself out at the part where the exterior is weakest by being less baked, whereas if the whole of exterior was already well crusted the interior would have to remain pinched. The above are actual instances, and although at first apparently conflicting, are not so, as the conditions are not quite the same, and the whole is perfectly intelligible after a little close observation, and is additional corroboration as to the difficulty in dealing with some of the apparent paradoxes in connection with bread in merely a few words.

When heads are inclined to come off, more proof is the best cure, but they can be helped by being pressed flat by hand on the boards before placing on the bottoms; and the latter or the whole when topped should not be pressed heavily or banged down, as is often done when just setting, which will make the throw worse. Although big heads protect the bottoms somewhat from holes, they are not to be recommended, because they sink into bottom too much, spoiling shape when cut, and by their tendency to topple over during proof the latter is often stopped by placing into oven too soon. Some ovens will throw or pull on one side more than others, but that is through unequal heating, and they should then be heated more in the first place and allowed to "lie down" longer, that is, more time should elapse between the heating, in the case of internally fired ovens, and the setting of the bread. A rash or flash heat will, all other things equal, pull and twist the bread more than a solid heat. Although a rash and fierce heat, and not lessened in its effect by a cloak of steam over the bread, will in the one case, as explained, distort the loaf, and in another case nip or pinch the loaf so that the part between top and bottom of cottage will be flat instead of rising gradually to a convex surface, a slow and cool oven will also allow a loaf to fall and be flat at this part between top and bottom, if the loaf be on the contrary over-proved and be beginning to collapse before setting. The loaf will "squat" in the oven, the same as it would if the constituents of its gluten were in the wrong proportions, as described under the heading of gluten.

Also, although unripeness and under-proof will most usually result in distortion and bad shape, it will occasionally allow the head to fall into the loaf too much, producing what is known as a collar; and this has been noticed when an off-hand dough has been cut back too soon after making, and thus checked and not again sufficiently recovered. It is evident that the gas, which in one case pushes the head off, will in the other case, when absent, allow head to sink. A fair amount of gas will tend to distortion when too much strong flour, or flour insufficiently mellowed by fermentation, is present; but in the extreme, when gas is practically absent there will be nothing present to cause distortion, even although the flour is still less changed. Strong unmellowed flour, by giving more resistance than weak, will more usually result in bad shape, but if there is no gas, there can be no more distortion than in the case of a piece of meat cooking, there being nothing to resist. This case is, however, very extreme, and refers more to an actual instance of great immaturity in the dough rather than to a loaf taken straight out of a moulder's hands, as, although moulding squeezes out much gas, there is usually sufficient power of fermentation to allow sufficient gas for the usual mischief in such cases. The pressing down hard that makes top push too much into bottom, showing, when cut in halves through centre, too much top and a too concave-shaped bottom, is often done when tops and bottoms are placed separately on boards after moulding, and getting a skin or too much cones, do not so readily stick when topped, and thereby get an extra push from the moulder.

A very frequent cause of bad shape in tin bread is the usual bad shape of tin. The tins are often too narrow at the bottom, and not sufficiently large to properly contain a full weight loaf when properly made from a slack dough and well proved—the consequence is they do not get properly proved, or else lop over the sides, and the tops of loaves pull over or burst out and make a slice of all angles. Plain or crumby bricks sometimes run into one another, one pulling a piece out of the other when parted after baking; this is found to be the case with an unripe dough, namely, one having a tendency to run on the boards. One does not see so large a proportion of this defect in the crumby or batch bread of Scotland and Ireland, which is usually riper than in the South of England, although on those sides that are larded, the pulling out and accompanying roughness would not be so much expected.

The class of loaves that are always the most regular in shape are Coburgs, or Brunswicks, or cake loaves, as practically the same sort is called in different districts. These are moulded in one piece without any topping or folding, being the same shape as pieces are when merely handed up previous to moulding into various kinds, and attain to good proof after moulding before setting into oven. These are not only more easily made of good shape but also of good texture, and also two can be moulded, one in each hand, at a time, and in less time than often one of another kind; they also lend themselves to being more easily moulded by machinery. They are on the whole quite as inviting as any other kind, and it is surprising that more of them are not made instead of the kinds more difficult to get right ; but if it was so, a good deal of the authors' consulting practice would be gone.

The above remarks concerning shape refer more particularly to cottage bread—the national loaf of England—because when writing the main portion of them during an earlier stage in the preparation of this book we had before us a cottage loaf and a letter from a correspondent needing information on this subject. In the case of tin or pan bread, a good shape should be easier to obtain, but the shape of the loaf is governed by the capacity of the tin in proportion to the amount of dough put into it, as well as by the shape of the tin itself. We are often asked what size of tin we recommend, and that is a difficult question, because individual fancies vary so much ; but it is safe to say that the very great majority of tins are not large enough to properly hold a full weight tin loaf to be of such a quality and character as it should, and if one wants to maintain one's characteristic shape, the best thing to do is to increase the dimensions in equal proportions.

Tin bread, both for quality and profit, should not be made from a dough fit for cottages, and then converted into so-called tin bread by merely being baked in a tin. It wants to be slack, and free, and well proved in the tin before going into oven, and then baked quickly in extra heat. In the great majority of tins a slack dough could not prove properly, because it would run over the sides, leading to a lot of trouble, and when the doughs are tighter and less proved, the loaves are often quite as much out of the tin as in it, and often pulled over on one side, and of bad shape, making a bad-shaped slice. This is of importance, as tin bread is primarily intended for light and good-shaped slices, and when slack, free, and well proved, makes toast that is not so prone to burn or get hard, but toasts quickly. There is, of course, much difference of opinion, because we have seen in the prize case at the exhibitions two loaves, side by side, one large, loose, free, well proved, and well watered, and the other small, close, slightly proved, and tight, and with the top almost breaking off, which would certainly come off when cutting a slice. We have also received, on the same day, two half-quarterns, one with a sectional area of 31 square inches, and the other with only 19. One of the best loaves we have ever seen was 7 to 7½ inches long at top, ½ inch less at bottom, 5 wide at top, 4½ at bottom, with a girth of 20½ inches round the centre, and 26 inches lengthways. The loaf that was awarded the championship some few years ago, and acknowledged to be of even unusual exhibition excellence, was in a tin of this length and breadth and 3½ inches deep.

The tins should certainly never be less than 4½ inches wide at bottom, but we often get them only 3½. Last year we got a bakers' sundriesman to make some ungalvanised or black tins, measuring 5 inches deep, 6½ inches long at top, 6 inches at bottom, 5½ inches broad at top, 5 inches at bottom. He said he should never be able to sell them, thought they were not wanted, too large, too unusual, etc.; but we recommended several people to buy them, and in all cases we have asked results, which have been found to be surprising to those who tried. Some have said they never before have had such good tin bread, and could not understand why they did not think of that little wrinkle before. It is as easy again to make good-shaped and well-baked bread in them. A loaf baked in one of these will be found amongst the illustrations, and although a little coarse from being proved a little too long in it, the excellence of the slice—like a quartern—will be seen. This perhaps may be a little larger than necessary, when weighed in light, and when best flour is not used, so as to carry extra water, but an extra large tin will always protect, never spoil, the shape of a loaf, whereas a small one does daily.

The difference made by such tins can be tested by baking the usual twopenny loaf in the usual half-quartern tin. The ungalvanised tins are also more porous and bake better and quicker, and when new, are like old in this respect. Their colour even by being dull instead of bright, by absorbing heat instead of reflecting it, helps the baking and makes a nicer crust, and this will hold good with brown breads. The object of having them tapered is to allow of more easily packing away, but they should not be kept out of use where steam or damp can affect, because of more easily rusting. The tapering is also necessary, because loaves when cooling usually shrink more at the top than at the bottom, and thus, except for this allowance, would look ugly when wider at bottom. In passing, it might be mentioned that the ordinary tins, when new, should have a thick coating of grease applied with a brush, and then baked empty for an hour in a cool oven after batch is drawn. The thick grease should then be removed with a cloth, and tins regreased as usual.

The greater amount of yeast now used, the quicker processes, the better flour, the more water, the greater expansion, and the greater necessity for full weight, all render the tin so often used undesirable in these days except for twopennies or closer meal breads. Where one wants to make sure of plenty of space being left in oven so as to get a good crust, and also to avoid the frequent layer of heaviness in the crumb close to the crust, it is well to have tins of oval shape or with a greater tapering. It is a poor substitute to shift the tins and give them extra baking, or to turn loaf down on its side before drawing, as is sometimes done. When loaf rises in the oven it presses against side of tin, helping to make a compressed layer there unless kept expanded by plenty of heat. A good tin loaf should not be made from overnight dough, but should be quick and warm; and, moreover, a batch of tins, where a good trade is done, can conveniently be the first batch in the morning, being got into oven, if absolutely necessary, in two hours from start, and thus filling up a gap or a wait that will sometimes be otherwise awkward where all off-hand doughs are adopted and started in the morning.

The practice of having a few tins in each batch and using them merely as upsets for the other loaves, and neglecting them generally, will not increase a trade for the kind of bread that can be made the most profitable. The tin bread in some of the large towns of the provinces, especially in some of the northern counties, is far better than that of London, and more of it is sold there, although London excels in the better finishing of the cottage and loaves from tighter doughs. Where the slacker doughs are employed, the pieces are often scaled straight into the tins, and after proving there, sometimes an hour, they are removed and moulded again. This sometimes leads to streaks, owing to the outsides getting cold and sometimes also greasy, and these outsides showing, when, in the course of moulding, turned inside.

An hour in the tin is not too long in some cases, whereas ten minutes is long enough in others, depending on the speed of fermentation and the heat of oven to follow, and also, of course, on the heat of the tin itself, which, in a quick trade, may often be filled almost as soon as the hot loaf of a previous batch is removed. Loaf should be moulded to fit tin, filling out the ends, and then proved until rising fairly evenly and flat, and the outer skin showing tendency to crack, but not actual cracks or falling. It will then, if from pliable dough, have small diamond cracks here and there when cool, and none of the bursting up at sides and ends, but even shape all over. It should not be left after it has got to the top, as then flavour is going and crumb is getting coarse, and should not be then put into cool oven, whereby it would get overproved and crumbly. Flour should not be too strong or weak, not a big percentage of gluten or of coarse character, but mellow, that is, quality rather than strength ; and the best grades of flour, such as Hungarian or best British patents, are particularly suitable for good tin bread, and return their value here better than in many other sorts. Split tins, that is, tins that are moulded in two pieces, often have a hole where they join in centre, and although fairly common in some districts, have no real all-round advantages. It is particularly essential that a boxed sandwich loaf should exactly fit the tin. It should be sufficiently compressed to make a close and tougher or firmer slice, but not large enough or proved enough to burst up lid and make uneven corners that have to be cut off and wasted. In this case the oven should be cooler, sounder, and less flash.

As regards cutting back a dough in the trough and handing up on the boards prior to final moulding, it may be said that dough cannot have too much labour, as far as appearance is concerned, provided sufficient time be given for recovery, and generally gets too little. With machinery, which will be fully discussed in a separate chapter, much of the manipulation after the first making can be dispensed with, because the dough is better made in the first place, and, also, with machine loaf dividers, the pieces emerge almost half moulded. Not only does the cutting back and handing up depend on conditions governed by machinery, etc., but also the speed of fermentation, and time available and kind of bread required, because every time the dough is cut or handled, not only is it checked by the letting out of heat, but also temporarily numbed by the labour. A quick dough then will be improved in fineness of texture and general appearance, but a slow dough will often be made slower, and then not get sufficient proof in the loaf stage, being thereby small and, perhaps, holey. With a long dough, one that has been in the trough all night, a cut back an hour before throwing out is almost necessary so that the dry and cold and, perhaps, skinny outsides may be turned in and have more chance of recovering and getting equalised, therefore showing less in the loaf; but in many cases it would be better, with a limited time, to give more of the time after the throwing out.

Bread is more frequently spoiled by too little time after throwing out than by too little in the trough, and the periods should be better divided. A very usual thing is to give one cut back in trough and one handing up on boards, but the loaf would stand up better, be easier to mould into final shape, and by that alone be improved in texture, if the piece were handed up twice, with proof in between and kept well covered, before being moulded. We have written a good deal on this at various times, and the practice is becoming far more general and popular, and is a development of the off-hand quick process. The second handing up does not take long, and has more effect on shape, and clearing, and silkiness of the loaf than a cut back in trough, and the moulding need not then be so severe as in some cases, allowing loaf to recover and prove more quickly. Well folding over and punching each small piece as it is cut up for throwing out of trough has also considerable benefit. The extra hand up and time will be particularly useful if the pieces are inclined to be runny, although extra time in the trough would usually be better in that case, as fully discussed elsewhere. On account of a cut back having the effect of checking, it should not be given until the dough has risen at least half more than its original size.

The extra labour, or passing dough through a brake or pair of rollers, or otherwise squeezing out the bladders or open places in the dough when on the boards just before moulding, makes much of the difference, with equal materials and fermentation, between an ordinary commercial loaf and a prize one. The light and porous bread of some countries and districts that is made from comparatively soft flour, is due very largely to the increased amount of labour at well regulated and frequent intervals. Such labour has the effect of putting strength into the flour by making the most of the gluten that it contains. The mere presence of eggs, butter, and sugar in goods does not always make them light; the creaming or beating up in the one case, and the making of layers in the other, as in puff paste, makes most of the difference, and manipulation applies in a similar manner to the constituents of flour when making bread.

The moulding should be fairly firm, with an unbroken skin, and particularly even, that is, without gripping or squeezing in some parts, and handling too loosely in others; and this matter, together with the amount of proof afterwards and the heat of oven, has considerable bearing on holes, as discussed under that heading. It is a useful check on oneself to occasionally count the number of turns taken during moulding, and it will, although not always, be usually found that the best moulded loaf, and the one that recovers itself quickest, is the one that has been got into shape in the fewest turns. Getting a loaf, however, into shape is not always—in fact, very often not—the same as moulding properly. Efficient moulding consists of gradually turning the piece round by the motion of the hand, whereby the upper portion of the palm or thumb joint presses outwards, and the lower portion of the hand, or smaller fingers, gradually tucks in, whereby the whole gets completely turned with a tension on the outer surface, a gradual stretching, and with an even pressure throughout, and not, as is often the case, with heavy pressure in some parts, or a grinding in a merely vertical direction on the outer part, while the other and inner parts are merely

Section of Champion English Cottage Loaf,
London Exhibition.
(ACTUAL SIZE.)

loosely pressed. Uneven moulding—that is, moulding some parts more than others—is a frequent cause of bad shape and holes, which is intensified or decreased according to the subsequent proof and baking. A way of teaching oneself is to put a pea in the middle of the flattened piece when commencing, and see how many turns are taken before it is uncovered again and falls out. If one does it in fifteen turns there is not much the matter; a machine-made or machine-divided dough can usually be moulded more easily.

The part that was cut by knife when scaling should be turned down when handing up, or laying up as some call it; and in moulding cottages the closings of the larger pieces are best put at bottom, because if put in centre of loaf by turning upwards there is more likely to be roughness, and a hole in the centre from hard tail, or cones, or otherwise, although if put at bottom an extra hot oven sole will often make itself felt. In the case of home-made or household loaves the closing would usually be put upwards to come in the centre. Some prefer to put them upwards in all cases.

As to whether or no a loaf should be notched, or have its surface cut after moulding, before baking, depends on circumstances. In very many cases it is not only a great waste of labour, but also a disfigurement, and is done, without regard to condition, merely because one has been in the habit of doing it. In most cases far too many notches are given, with the result of taking much time, and also done very carelessly, and they then certainly do not give any improvement in appearance or any extra crust, which are the two most usual features urged in their favour. These notches are often nothing more than ugly scratches, and at other times they open out exposing white lumps of flour and other evidences of a badly made or scrapy dough. To some extent, however, they have the effect of covering up and minimising other faults, for instance, although two wrongs never properly make a right, a top that is covered in notches does not so much expose to view what otherwise would be a very grainy, coarse, rough, uneven crust, owing to bad moulding and smothering in cones or else dry flour. In the same way the abundance of notches largely hides the pretty effect of a well moulded, even, symmetrical, smooth, and nicely bloomed crust, and such a crust, in otherwise its natural simplicity, is spoiled by notching, and the skill of the moulder discounted.

The other fault that notching sometimes helps to cover up, is lack of proof and consequent holes, because it lets out some of the gas and provides an escape for it in the oven whereby the crust does not burst or the loaf does not blow so much. In the same way a bash hole allows gas to escape, instead of the crust being blown up, as it would readily be seen to be if the bash hole, as in some cases, were to get stopped. Also the notching helps to preserve the shape in such cases by keeping the loaf from being pushed over or pulled on one side so much. Obviously, however, the right course would be to prevent these blemishes by allowing the gas to evenly distribute itself and the loaf to recover from the moulding, by giving more proof in a moist atmosphere, such as steam, and preserving the porosity of the surface, preventing the formation of dry skin, by keeping covered. If a loaf be notched at all, so as to allow expansion of the interior after the main portion of the crust is set or fixed by the heat, the notches should be notches and not scratches, should be deep, and only in about four or six evenly distanced places, being uniformly applied (instead of being the ill-considered gashes of a madman seeking vengeance), and even then it is a question whether the loaf stands up so well or looks so nice as one that has been unnotched, when properly and well manufactured.

In justice to inventive genius, we must say there may be notching and bashing machines that are good, but at present all we have seen and all the loaves manipulated by them have been unsatisfactory. The so-called notches have been merely marks, even the surface of the loaf has not been cut, there has been no opening out, no escape of gas and no extra crust, and the pressure exerted, evidently with the idea of making the blades cut, has merely flattened and compressed the loaf. It is claimed for these machines that they save time and labour; if that is so, hand notching evidently is admitted to absorb this time and labour, and then the important question, as indicated above, comes in, namely, why notch at all? While speaking of this surface cutting, it would be as well to remember the very great difference in appearance that there is when cutting Coburgs, namely, when cutting each one singly, as should be done, and with a sharp knife squarely across the centre, and, on the other hand, when dragging a knife from end to end and then across a whole board or whole row of them at one operation, thus cutting them unevenly and often dragging the skin, and generally spoiling the entire object of cutting. See illustrations.

Recognising the effect of imprisoned gas, some men put a small fork in two or three places into the crust of their tin loaves; many of these have been seen at the exhibitions, and it has been said, by those in a position to know, that this piercing has been considered as distinctive ear-marking, and, in order to save any room for the unjust assertions sometimes ignorantly made concerning judges knowing whose loaves they are judging, these have accordingly been thrown aside. In the same way, for special loaves, it has been found advantageous to put a skewer through the centre; and being inserted when clean, through the bash hole, it cannot be so readily detected. It must be further remembered that the effect of the notch on the cottage or the cut on the Coburg depends greatly on the amount of gas and the ripeness of the dough. If unripe or green, the notches or cuts have a tendency to run or flow together again, depending on the tightness of the dough and deepness of cut, but if fully or over ripe they will open out considerably more. A good instance of this principle is often seen when making hot cross buns, the size of rent made by the cross depending a great deal more on the state of the bun than on the size of the cross. Likewise, some loaves, by being made from tight and ripe dough, will retain the name that has been imprinted on top by a docker much more plainly, the name being much more legible than when made from a less ripe or slacker dough, which would help the impression to close up again.

In the same way the folds of a loaf will not join up or stick together so easily, but often open out, leaving a crevice especially seen at the end of Scotch plain loaves, if the dough has been very ripe, losing its stickiness runniness, and moisture, or if otherwise dried by tightness or too much dusting or cones. And also, when over ripe, such Scotch loaves are sometimes found to crack about half way up. In the same way, when thrusting hand or arm into a dough when in the trough, the rent, dent, or impression made will be greater or more easily made when the dough is ripe or ready than when unripe. In the latter case, the arm will be resisted and the dough will be more springy and squeaky, and if then taken, and not afterwards compensated, the loaf would be small, foxy, or red, rough, ragged, dark, with a crust, tough, leathery, flinty, instead of being short and easily pulverised or splintered. If over-ripe, the crumb would be crumbly and short, and the head, in the case of a cottage, would not be tightly stuck to the bottom, but would easily pull off, and, in extreme cases, fall off with very little touching, and not be accompanied by that prickliness and local roughness or integuments holding the two together. There would be a dulness, as opposed to the glossy brightness of the more healthy one, and also other characteristics that come within the subject of sourness.

THE CRUST

THE crust of a loaf of bread affords considerable guidance, in the hands of an experienced person, as to the health and character of the loaf, its constituents, and method of manufacture, and as to the amount of skill employed. In addition to the colour and bloom of the crust which we have already considered under their respective heads, there are many other physical signs such for instance as crevices, bursts, or large deep cracks, and also small surface or diamond-shaped cracks. These large cracks show inelasticity of dough. They may be due to soft flour, that breaks short, or strong flour that is overworked. Although flour and fermentation are thus causes under some conditions, it is not always that the cause has the same effect, the latter being governed by the final stage, namely, the amount of proof after the loaf is moulded in proportion to the heat of oven. This refers particularly to the bursts at the side and the ends of tin loaves, the crust of which, when the loaf is under-proved and put into a hot oven, pulls up from the rest of the loaf leaving a crevice in which one could bury one's fingers, instead of the loaf being evenly square without any rugged places or edges.

Although the pulling away and this breaking off short will, all things being equal, be greater if the percentage of starch be great, or the gluten be exhausted, and although this gluten would be more exhausted the more it is fermented, nevertheless, extra change of the gluten does not necessarily always mean a bigger crack, because the pull is always strictly in proportion in its effect to the amount of resistance. When then the loaf is given more time after moulding, that is more proof, the crack is less, because the loaf is less stunned and more pliable, therefore better able to respond to the pull, making the strain less. It is not so much the amount of the degradation of the flour as the period at which the degradation is allowed to take place. This fact of one circumstance compensating another, is much the same as where phrenology finds that a man may have the organ of language large, and yet not be able to speak in public so fluently as a man with the language organ less cultivated, merely from the fact that he may lack the organ of self-confidence, whereby nervousness would overrule the other characteristic.

Passing from these large cracks, crevices or bursts, let us consider simply the thin surface cracks which are very little more than lines crossing one another, forming little pieces that will flake or break off in diamond-shaped squares. These are a sign of quality and take place usually when the loaf is cooling on the shelf, and give that characteristic crackling noise that one likes to hear when loaves are just removed from the oven. They will very frequently be found across the top of tin loaves that have been made as they should be, from a free and slack dough, well proved and quickly baked, and they will be usually absent from a crust that is tough and leathery from immature dough, or a crust rendered thick and hard by a cold slow oven. Such a crackly, pliable, thin crust indicates altogether a superior loaf, on the whole, than one whose crust is hard and unyielding, such as is often well expressed by the term "corky," the latter making the bread seem to get stale in very much less time than the other.

To some extent one can tell some of the characteristics of a loaf, with one's eyes shut, by feeling the crust. If it feels smooth, and the fingers sometimes seem more sensitive when unaided by the eyes, it is a sign on the one hand of skilfully moulding it clean and green without any accumulation of dust and cones, and on the other hand, of ripeness in the fermentation or tightness in the dough. The drier and less sticky the dough is, the easier it is to mould smoothly, and ripeness in the fermentation or tightness in the dough will help dough to handle drier. The presence, however, of a skin that is formed merely by the surface of the dough being allowed to become dry, or dryness caused by an excess of dust or cones, or the loaf being merely wound round instead of having its surface well stretched in the course of moulding, will give a coarse and grainy crust, characteristic of amateur, or bad, work. Where the crust is crisp, and short and well aerated, it indicates a comfortable fermentation and a well ærated dough. Where the fermentation is slow and dead, the surface of the loaves when coming into contact with the heat will give a crust of a close, tough and leathery character instead of crisp. Where the crust is flinty and sharp at its edges, or too prickly between the top and bottom in the case of a cottage, it will indicate flour with excess of one of the constituents of gluten, namely glutenin, or unripe fermentation. One finds this characteristic in Scotch bread far less. Very much the same reason, apart from the question of time in oven, can be ascribed to a thick crust which is not often present unless fermentation is incomplete or checked, a riper loaf, providing the baking is the same, usually having a thinner crust.

The crispness and toughness will also depend on the amount of moisture in the crust, it being advisable, for the sake of crispness, for the crust to be well dried before leaving the oven, and this is particularly so in the case of Vienna bread. The crust will frequently, in fact almost always, be tougher when stale than new, simply on account of the crust becoming more moist on exposure to the air. When the bread is drawn from the oven there is, of course, a higher percentage of moisture in the crumb than in the crust, and the moisture in the crust will rise from about 10 per cent. just after baking to double the amount in the course of a day or two, and will get tough on that account, the same as it would if the gluten had been undegraded by insufficient fermentation, or the dough bound by an excess of salt, or the dough been allowed to take on a skin.

The crust may also be an indication of quality according to the amount of gloss and shine upon it. A bright gloss is a sign of quality in the flour which has not been destroyed by too much fermentation, and should be distinguished from a dull smoothness, which usually shows itself in the corners of the loaf or on the badly baked portions. A dark, smooth shine is a sign of too much change, the latter being usually greater as the patches of shine are darker, or discoloured round the edges, this being particularly noticeable in the case of sour bread and usually where the dough has been fermented by a long, slow, process, and then not well crusted in the oven. This slimy shine should also, of course, be distinguished from the gloss caused by steam. There are frequently seen "crinkles" or roughness round the bash on the top of a cottage loaf. These are due to a skin having been formed on the top of the loaf by standing and allowing to become dry, and are produced by the skin being displaced and drawn together during the process of bashing. Inasmuch as a slack and lively dough is not often allowed to stand long, these crinkles may often be taken as indicating a tight and slow loaf.

RUNNY AND STICKY DOUGH

THE runniness of dough is nine times out of ten, with the flour now at command, the result of insufficient fermentation. It is seldom, in these days, that the amount of water in the flour, as received from the miller, or the amount of instability and stickiness in it, is in such an excess as not to be dried up or well amalgamated by proper fermentation. Warm water and plenty of yeast, well harnessed, should almost always be able to prevent this tendency to runniness, as far as it usually exists, and this fault is, therefore, due usually to the management of the dough, rather than to the amount of water naturally in the flour, or put into it by the baker. The baker, however, sometimes errs by putting in too little water, rather than too much. The opposite of runniness is binding, yet many people, when they have a bound loaf, blame the flour just as much as they would if they had a runny dough. If one blames a flour with a tendency to runniness, and puts that tendency to runniness down to the excess of moisture or instability in the flour, one should, perforce, praise instead of blame a flour that binds. A dough with an excess of water when unsupported by a sufficiency of gas sometimes spreads ; a dough that is bound stands up like a ball, and is one that wants more water to give it more freedom. A dough that binds is, nine times out of ten, made from a flour whose constituents are very sound, whose constituents will, therefore, take plenty of water, and when they do not receive the proper amount, the particles and cells in the flour do not swell, as water would make them do, and thereby occupy a smaller space than they should, and thereby give a loaf that is known as bound.

Inasmuch as binding can be overcome by more freedom being given to it by more water, and as water costs nothing, binding, especially if runniness is correctly ascribed to poorness in flour, should be put down as a sign of quality, and as quality of which sufficient advantage has not been taken. This is borne out by considering for one moment the characteristics of high-class patent flour, especially Vienna. Inasmuch as Vienna commands a higher price on the market than anything else, it must be regarded as of high quality, yet unskilful handlers of it complain of it because it binds. When using it for Vienna bread it does not bind, because good makers of this class of bread, whether they know the reason or not, usually make their doughs slack, and, irrespective of the yield or profit, know they cannot so easily get a good quality Vienna loaf when the dough is tight. It is for

BASHED COTTAGE

(Photographed tilted to shew the top).

this reason that many do not like Vienna flour, irrespective of price, in ordinary household bread, because such doughs are, nine times out of ten, made too tightly in proportion to their subsequent treatment, and it is because the flour does not get what it requires that they complain of it. Not only do they spoil the quality, but do not get out of it the profit that it should yield. Competition is quite as keen, prices are quite as much cut in Manchester and district, as anywhere else, yet a very large proportion of this high-priced and Vienna flour is used in that district. It is simply because they make the doughs slack, thereby getting the quality out of it, and paying for its extra initial cost by giving it the proper amount of cheap water that it requires.

By looking at the opposite side of a question one can often obtain useful information and guidance, but in most problems of bread-making one can always adduce evidence of a most conflicting character. Take for instance the assertion that runny dough is due to soft flour. Vienna is not a strong flour yet it usually on the contrary binds. An English country patent is softer still and will often bind up into a ball. The highest grades of most of our large port mills are less strong, contain less gluten and more starch than the lower grades from same mill, yet they bind more. The flour from California, such as Cascadia, would be called a very weak and soft starchy flour, but it also binds instead of running. The same with many winter wheat patents and biscuit flours. Gluten is considered typical of strength, but Argentine wheats have more gluten than the Californian referred to yet are more inclined, other things equal, to be more runny and sticky in the dough. Under the heading of gluten the effect of percentages of the latter on the strength of the flour is fully considered. In some cases a flour with a very large percentage of gluten has been soft and sticky, and the cause has been traced to a deficiency in the glutenin. The longer a flour is fermented the softer it gets. No gluten can be extracted from a sour dough, yet a sour dough will not run, in fact on the contrary it shrinks and binds and there is not enough stickiness about it to close up the folds of the loaf or, in the case of a cottage, even to keep the head firmly stuck to the bottom. There is no gluten left and nothing will stick. Rye flour, however, never has any of the same quality gluten as wheat, and, by not holding gas, makes flat and runny dough.

After all the above has been said one has to come back to the fact that the same flour will often be considered runny by one man and not by another, and moreover will also be found to be less runny one day than the next. If a dough has run together on the boards, the pieces sticking to one another, is then scaled again as it often has to be, it is a well-known fact that it will have less tendency to stick the second time ; it would stand longer before beginning to run. If a tendency to run or stick has been noticed it would be best to hand up, or roughly mould, the pieces twice instead of the usual once before the final moulding. The next day the dough should be given another half hour in the trough before throwing out. Although time or more fermentation in the trough will be found to decrease the trouble, the pieces will, of course, run together more the longer they are left on boards, unless checked by labour ; therefore, when once out of trough, quick handling and a small batch is best. Gas naturally rises, and therefore helps to hold the loaf up ; water is weight that is always trying to find its own level. The stronger the tissue of the flour the more the gas will be held in, but it is no use having strong tissue unless the gas is there to distend it ; and the more that tissue is weighted by soluble matters and water, the more the fermentation and gas has to overcome. Extra salt will be found to advantageously toughen the tissue and help to bind, but as salt hinders fermentation, and thereby production of gas, more yeast or time must be given to compensate. As with a tendency for runniness a quick evolution of gas at the finish is desirable, the necessary amount of fermentation would be better conducted quickly than slowly, especially is it also necessary to get consumed any of the excess of soluble matter.

Under the heading of malt extract or dryness will be found details of an experiment with an excess of malt extract, which would give stickiness and increase the soluble matter helping runniness, wherein it was found that the malt extract became gradually less in loaves that were taken from the main piece of dough at extended intervals. The tissue of newly ground flour or flour from damaged or sprouted wheat is less tough and less stable, and in the latter case alum and lime water, which are considered under separate heads, and also common soda, used to be added as having more effect than salt. Such flours are best worked by a freer and shorter process than usual. New potatoes, like new flour, are more sticky than old ones. Another point bearing on the necessity of sufficient ripeness, in order to avoid runny dough, is the flatness of artificially ærated bread, in which there have been no fermentative changes, and which is, comparatively, very seldom seen made in a cottage shape. The very slack tin doughs of some parts would be found to be excessively laden with water, except for the very quick and vigorous fermentation ; they would be heavy instead of light. When the pieces stick together on the boards it is usually some trouble to part them ; they will pull out before coming asunder unless one takes hold close to the join : it is therefore fairly evident in such cases that the flour still has plenty of strength ; when it breaks off short and rotten, it is, of course, an indication to the contrary. In correspondence at various times with those who were seeking relief from runny dough, we have frequently, in corroboration of unripeness being the cause, found that when the weather became warmer the trouble ceased of its own accord, and also that a sudden change of weather to coldness, or a dough which had got cold, or a dough taken when round and not fallen, was the sole cause of anything different from usual.

TIGHTNESS OF DOUGH

IN a general way tightness would be defined as the state of being tight, and tight would mean close, compact, that is, not loose or open, but in bread-making these meanings of the word resolve themselves into merely the state or consistency of the sponge or dough as effected by the amount of water added. Tightness, like many other details in the process of bread-making, has respectively advantages and disadvantages, according to the conditions of work and the results required. For instance, the dough at the moulding stage when required to make special loaves, such as for exhibition purposes, should, in the case of such sorts as crusty cottage, be usually tighter than it is; whereas for ordinary commercial purposes, under usual conditions, the dough should usually be slacker than it is, particularly in the case of tin bread. It is practically impossible to get perfection in either quality or profit in all the various sorts of bread, under all the various conditions of manufacture, with the same degree of tightness; yet the great majority of bakers place far too little importance on this point, and if anything near uniformity was possible, the subject could be dismissed in far fewer words than it will be necessary to employ.

In the first place, it should be remarked that in no preliminary stage in the process of bread manufacture should there be tightness, if the object of that preliminary stage is to increase, as it should ordinarily be, the vitality or power of fermentation. A tight sponge or a tight long-process dough is impeded in its activity and development in the same way as a mass of tight clothes impedes and oppresses the activity and development of the human body. The tightness or lack of water within the sponge or dough will hold it down just as effectively as if it were encased outside, the amount of the resistance being, of course, effective in proportion to the amount of power present or exerted. Thus a tight sponge or dough means more yeast, unless otherwise aided, for doing the same amount of work. If, then, a sponge is set for the purpose of increasing yeast it should be slack; but if, after deciding to thus increase yeast, one is so inconsistent as to want to keep back the sponge, so that a long night's rest, or other interval in the manufacture can be obtained, then it should be tight. Nevertheless, it would obviously be more consistent and economical to restrain the fermentation, and the amount of the change in the constituents of the flour, by decreasing the amount of fermentative power and the size of the sponge rather than strangling the larger.

In the same way a dough that is tight when on the boards is not economical, because it will not only contain less water, but will require longer time to arrive at perfection after moulding, especially unless it was supplied with more yeast at the start or more heat, or else had more yeast grown in it, and the changes slowly developed at the cost of flavour. It is this slowness of proof, and therefore the necessary time required in order to avoid pinched or badly shaped bread, that is a great objection to tightness in ordinary commercial practice, where there is not the patience to give the proper time, or where it is not convenient to have much dough in the form of loaves, occupying much space, lying about awaiting baking. When, however, the amount of water and the amount of profit, and the amount of time and care for perfection, is not of such prime importance, as it would not be in the case of good priced or exhibition bread, then undoubtedly the eye can be better satisfied by a tight dough in all cases where the loaf is to be baked on the oven bottom, and unsupported by any tin or contact with other loaves. There is nothing to beat in appearance a crusty cottage loaf that has been made as tightly as possible, tight enough to be braked like a biscuit dough, tight enough to need chafing rather than moulding, and tight enough to stand, and needing to stand an hour after final shaping before being proved sufficiently to go into the oven. The shape, provided, of course, all the previous process was in accordance, would be perfectly symmetrical, standing up like an evenly carved pyramid with a smooth and regular surface; the texture would be of even and fine mesh and with no sign of the very frequent holes in cottages, and the colour would consequently and thereby be improved. Although dryness, as discussed elsewhere, is not solely dependent on the amount of water added, this defect is more likely to be present with tight dough than slack.

A loaf from a tight dough will, however, usually cut closer, and in most cases, by being less free, will be of smaller volume, and consequently yield up by evaporation its water less quickly. Although tightness is thus seen to have some advantages in crusty cottage bread, it should not be recommended for tin bread, which should be freer, lighter, more spongy and softer in texture, of larger volume, and, as the tin renders better shape and texture possible in conjunction with more water, the latter should have more consideration. Within reason, and with the qualifications as given in this article, a special cottage with suitable manipulation can hardly be too tight, and with the same qualifications a tin cannot be too slack (this does not mean to countenance the excessively slack brown doughs that are slopped on the scale pan); a tight tin is as much opposed to what it should be, as is a very slack cottage. The two cannot be made to perfection from the same dough, and even for ordinary daily results should always be made from doughs of different degrees of tightness, as well as receiving different manipulation.

The quantity of water that would make a sack of flour (280 lbs.) into a tight dough would vary according to the quality and character of the flour, and also according to the way in which it was incorporated during the kneading or making of the dough. With ordinary mixtures, however, 1 lb. of water to 2 lbs. of flour, namely 14 gallons or 140 lbs. water to the sack of flour, would make what should be called a moderately tight dough. The writer has received many loaves within the limits of 13 and 18 gallons to the sack, and in cases both below and above this. The very tight or 13-gallon ones have usually been from the South of Ireland, the very slack or 18-gallon ones have nearly always been from Manchester district, the 16-gallon ones have been on many occasions from Scotland and not baked in pans. The 14-gallon ones, both for cottage and tins, have been very usual from small provincial towns or villages where all sorts, by reason of small trades or wanting some of each shape for early delivery, have been made from same dough. Although small batches can be, and are usually, made slacker than large ones, some special exhibition loaves have been made, being most accurately measured, at less than 13 gallons to sack. A range of even 13 to 18 gallons, a difference of 50 lbs. water to 280 lbs., is very wide, and in all cases this means without the addition of unusual matters. With additional matters, instances of wider range could be mentioned, but belong rather to the subject of yield.

Referring to points of detail, it may be said that up to a certain point of tightness the dough lends itself better to handling and moulding with an even surface so as to give a smooth crust, that is, all things equal, it is easier for an unskilful moulder to get a good finish with a tight dough than with a slack. When, however, the dough is very tight the moulding is rendered more difficult for proceeding in the same manner and completing properly in the same time. If a medium stiff dough be handed up hard, then moulded very firmly or ground up in the hands, it will give very much the same appearance, as regards proof, as if a tighter dough had been handed and moulded more loosely and thereby allowed to loosen itself sooner afterwards. The tightness or slackness of a dough will thus be sometimes inaccurately estimated by feeling the hardness and unyielding character of the crumb of the loaf; and also a corky or hard unyielding crust may indicate tightness on the one hand, and be difficult to distinguish from a similar crust caused by a less tight dough that was by moulding, or time, allowed to afterwards loosen or prove less. Although tightness helps shape on the one hand, it will not help it on the other if given no more time for proof, therefore being less proved, after moulding and before baking. The same remark will apply to holes in connection with tight doughs. Although tight dough properly handled would make more even shape and less holes, it must, if under-proved, crack and burst when baking, not being able to stretch like a slacker one.

In the same way, other things being equal, the folds of a loaf, when cut, will show less and amalgamate better with a slack dough than a tight. Also the folds or any crevice will show more on the crust or on the outside with a tight dough. Sometimes a tin loaf will show evidence of having been in tin a good while, but if the dough be tight, there will be crevices that have not been filled up as would be the case with a slack dough. Other signs of a tight dough, with always due consideration to ripeness in trough and proof after moulding, will often be a thicker and less pliable crust, not splintering when pressed with finger, and in the case of a cottage, the notches will be angular and remain as they were cut, and any letters that might be impressed by a docker will remain distinct as if docked on cold butter. Some flours during fermentation will "give" or get slack more than others, and need or will stand more tightening up afterwards; but others, on the other hand, are very stable and give hardly at all, and if made tight in the first instance will bind and not be satisfactory, such, for instance, as Vienna, even with extra power for driving them up. As flour, on the whole, is more stable and drier than formerly, the dough does not need, when made, to be so tight to enable it to stand a long while, and in practically all cases it is best not to be tight when making; but, if required to be tight for special purposes when on the boards, the extra flour for that purpose could with better results, although perhaps a little more trouble, be worked in while cutting back thoroughly half-an-hour or so before throwing out of trough, or by well dusting and tightening up when passing through a brake, which is always an improvement for fine bread when suitably manipulated. This tightening up or adding fresh flour will be found particularly serviceable in the case of overnight, off-hand doughs, rather than adding all the flour when first making; also with exhibition bread.

TOUGHNESS

ANYTHING is said to be tough when yielding to force without breaking or when flexible without being brittle. This state is often noticed in the crust of bread, and to a less extent in the crumb. The chief causes are insufficient fermentation or mellowing of a strong flour and too much moisture in the crust. Too much gluten, or gluten insufficiently changed, amounts to the same thing in this respect, therefore extra yeast and warmer water or more time will soon create shortness, the same as the addition of any shortening such as lard. A skin on the surface of loaf before baking, but more particularly insufficient baking, is a frequent cause. Vienna loaves that are drawn from oven when the surface is moist with steam will be tougher than if allowed to remain a little longer after the oven is opened and to get dry. The crust will usually be tougher when stale, especially when kept by the housewife in a closed earthenware bread pan, because some of the moisture of the crumb is absorbed by it, and the

A GOOD COBURG.

moist atmosphere of the pan prevents it getting as dry as it otherwise would, which can be proved by removing loaf and standing in a draught. Bread baked in iron ovens or on iron soles is not always necessarily tougher than that of brick ovens if it be thoroughly ripe when set and thoroughly baked ; although, of course, the brick sole will absorb the moisture better and bake more gradually, usually giving a more porous crust. The smaller quantities as baked by housewives in iron ovens are not tough, even when no shortening added, as they are dried out by slow baking in a dry heat.

PROVING

THE word proof has a large variety of meanings according to the subject to which it is applied and is also sometimes used somewhat loosely when applied to breadmaking. We should define it as being the *amount* of expansion or recovery allowed to loaves of dough in their final stages, that is after shaping and before being stopped in expansion by heat of oven, irrespective of the amount of fermentation previously allowed in the trough or the *time* given on the boards. Under or over fermentation in the trough will not counteract over or under proof in the loaf, and it is quite possible and very often the case that a loaf is over fermented yet under proved. Proof is such an important and distinct part in the process of a loaf's manufacture that it is customary to speak of it by a different term than the fermentation in the trough, but of course proof is, strictly speaking, the final stage of fermentation, the latter commencing from the time the yeast is sown and finishing when killed during baking.

The speed with which a loaf gets the necessary proof, although defined as something separate from the earlier stages of fermentation, depends on the latter largely. Some loaves require much more time than others to prove or recover after moulding in order to be baked so as not to be distorted by heat of oven, while others would not stand half the time without, on the contrary, suffering injury. A dough that is working sluggishly will prove sluggishly, and must have time after moulding no matter how much it may have had in the trough, and as a rule it is the one that has had most time in trough that also, for purposes of shape, wants most time after moulding.

A cottage loaf that has been made from a steady sponge and dough or a long straight dough, and has been made tight, can often do with an hour to prove in boxes or drawers to its advantage and would be of bad shape or holey with less. A tin loaf, on the other hand, that has been made from a very quick and free dough with a lot of yeast and a lot of water, would when placed in a small tin be all running over the sides in that time, or have proved itself to death, getting very coarse and crumbly, although there are plenty of tin loaves that under other conditions could stand as long without harm. When they have stood in the tin a long time the sides are usually shiny, and if under proved the bottom crust will often be drawn up in the centre like an arch, and the ends burst out. Tin loaves are usually proved more than cottages and are by their tin less exposed to heat in oven than crusty cottages, but the latter are in the great majority of cases moulded up and rushed into the oven much too hurriedly and under proved, and this accounts largely for the difference in these two sorts, and other sorts of loaves, as regards shape and holes which are fully discussed under their separate headings. A loaf must prove more when going into a hot oven than a cold, and when well proved will bake quicker than when under proved and closer. A good plan for convenience of proving is to have a number of boards made that will hold five loaves one way and three the other, a total of fifteen. These are handy for getting rid of the loaves and can be supported one on top of the other, near the oven by means of small angle irons. A jet of steam, or a pot on a gas ring, underneath will keep them warm and moist on the surface, as is necessary for quick proving and bloom, especially when made from a long slow process. In larger bakeries or with drawplate ovens movable racks are best and boards of a length to fit across top of drawplate. The majority of loaves as usually made should have fully half an hour to prove on these boards (or in the drawers which they become when put together and covered) so as to recover from the moulding, topping and bashing. They should not have the proof knocked out of them again by rough handling, and heavy bashing and docking when setting, although the amount of such handling they will stand without injury will depend on the freeness of the dough and the heat of oven. When the loaves are topped and left on the tables the opportunity can be taken to straighten and bash them after they have stood a little while, say at half time. Unless the dough is moving very quickly it is not enough to get merely a few courses ahead before commencing to set into oven as is often done. A tin loaf, unless tight, should not be set into oven until it is flattening on top and showing signs of commencing to crack, and a cottage should be plainly seen to have increased in size and filled out all over, as it would not be if taken straight from the moulder's hands as is done in some cases.

BAKING

THE baking of a loaf is a most important stage in its manufacture, because thereby it can be much improved or marred in quality according to the suitability of the oven in relation to the state of the dough. No absolute time or temperature can be given as the correct one for a loaf of bread while in the oven, because both must be exactly in harmony with the batch to be baked. Strictly speaking, however, the goods to be baked ought to be in that condition whereby they should bake in the shortest time at the greatest possible heat without burning. That is, the goods should be in a condition to stand a hot oven, rather than the oven be kept cool for fear of it not suiting the goods that were not in condition to be baked to perfection, owing to the neglect of giving sufficient proof before baking, whereby a loaf would be usually distorted if put into a hot oven.

A great quantity of bread is too slackly baked, that is, it is boiled, not baked, remaining for too long a time in too cool an oven. The dough that is proving slowly, owing to a long slow process of fermentation, such as would be made from patent yeast, is always found to require longer in the oven than a loaf that has been made from a quick and free fermentation, and therefore proving quickly. The greater time in oven, and the cooler temperature is necessitated by the small bulk of the under-proved loaf, whereby more time is required for the heat to penetrate, and also as in an under-proved loaf the gas takes longer to disseminate in all its parts, which gas, being unevenly distributed, would, when in the oven, be bound to blow into holes or otherwise distort the loaf.

It is this fact, that a quickly fermented loaf will bake more quickly than a slowly fermented one, that commends the quick process to popular use, because, all things being equal, the quicker the loaf is baked the better it will be in all respects. A hot oven will stop the fermentation in the loaf quicker than a cool one, giving a better flavour, not only because of quick baking but by reason of its driving off the stale gases formed during fermentation, and also by baking quickly will keep in the flavour, and moisture, in very much the same way that a piece of meat when cooked in a rash heat will be nicer eating by having its juices retained rather than gradually simmered out. Inasmuch as a hot oven stops fermentation sooner than a cool one, a loaf must necessarily be more proved before it goes in. If the loaf is sufficiently proved as to be suitable for a hot oven, it will become over-proved if it is then put into a cool one, and if it is proved only sufficiently as would be necessary for a cool oven if put into a hot one, though, perhaps, improved in flavour, it will be very ugly. Different grades of flour will stand respectively ovens of different degrees, but this is better dealt with under the heading of bloom ; also a loaf with a greater proportion of water will, all other things being equal, require longer baking.

Another great point affecting the time and heat necessary for perfect baking is the kind of bread, and how it is set or spaced in the oven. It is obvious that two cottage loaves from the same batch of dough one set against another, thereby having a crumby face, and the other set so that the heat gets at it on all sides, that the latter must bake more quickly than the former, and in the same way rolls off the same dough would bake in half the time required by a 2-lb. loaf. Much of the difference in flavour in the roll and half-quartern loaf from the same dough must, of course, be due to its quicker and better baking, since that all other points are equal. In the same way it is a matter of common experience that if a batch be unexpectedly large, the first part of it is often crammed into the oven, and the second part is oftentimes put in the same oven after the first one has come out, and although it will have been fermenting longer, and also even when the oven has not been re-fired, the second batch will often be sweeter and of healthier appearance than the first, merely by reason of having had so much more space in the oven.

The ingredients also have a bearing on the time of baking, because sugar attracts the heat, whereas fat or lard repels it, and the flavour of the latter is always objectionable when a loaf is under baked. The more the outside is exposed to the heat, of course, the greater is the amount of crust, and the water from that portion of it is, of course, driven off, making the loaf lighter; but if the crust loses water, the latter does not evaporate so quickly afterwards from the interior of the loaf, and as a matter of fact there is a more dry bread produced by slack baking, or bread that has been in the oven a long time at a slow heat, than bread that has been well crusted and baked for a short time in a good heat. The volume of the loaf will be affected by the oven according to the state of the dough; if the loaf be full of gas, the volume will, of course, be increased because the gas will expand by the heat, and insufficient heat is often seen to produce a closeness of texture, as in the case of tin loaves that are set too closely so that the heat cannot get between them, whereby there is a close layer down each side of the loaf which is thicker and darker on the side that has had least access to the heat.

The kind of oven and the amount of steam therein must also have considerable effect on the time and temperature for the proper baking of a loaf; if the oven is built in a solid and substantial manner it, of course, holds its heat very much better than one not so built, besides this some ovens are externally heated, whereby they do not lose heat while the batch is being baked ; and the greater the amount of steam that would be injected from outside sources the hotter should the oven be heated, because the steam while keeping the crust moist and giving bloom, at the same time protects the loaf from heat. A solid heat will penetrate the loaf further, making a thicker crust than a flash heat, and the latter has more tendency to distort the loaf and give it good bloom.

If the loaf be properly baked the crumb should spring back easily when pressed by the finger, and not be doughy or leave any impression ; in fact, with a thoroughly baked cottage loaf it has been sometimes demonstrated that one could sit upon it and it will rise and open out again like a concertina. A good heat for loaf bread, according to its size and condition, would be from 450 to 550 degs. F. when commencing to set, but these temperatures must be given with a somewhat wide range, because different ovens showing the same heat by the pyrometer or thermometer will bake very differently, sometimes owing to the incorrectness of the instrument, sometimes according to the position in which it is put into the oven and other individual points.

The heat inside a loaf will not, of course, be anything much above the boiling point of water, say, about 3 degs., only in the centre, and gradually increasing towards the surface, being just under the crust at a temperature of about 320 degs. The time would vary for half-quartern loaves according to actual instances from thirty minutes up to about two hours. It is no uncommon experience for the author to receive a tin loaf thoroughly baked in thirty-five minutes, and forty or forty-five minutes is quite sufficient for a cottage loaf that had been subjected to an average temperature of 450 degs. for the whole time in which it was baking. Plain or crumby bread will require longer, and in many parts of Scotland and Ireland two hours and even longer is the time given for half-quartern loaves, nevertheless, the author has seen many loaves of the plain or set bread referred to from such places, which have been thoroughly baked in one and three-quarter hours, and even less.

A good heat during baking will usually be found to bleach the crumb, and although the crumb of Scotch bread with its slow baking is bleached more than bread from most other places, this bleaching is due to other causes. In the south of England one usually sees every crevice round the oven door tightly stopped during baking, so that no steam should escape, and it would be considered very wrong to open the door until drawing time; it is therefore somewhat interesting to remark that, in Scotland, the oven door is frequently left open for a full half hour after a batch has been set, and in cases even longer.

There has been much said concerning the sterilisation of bread, but as the majority of the germs that do any harm are killed in far less time, and at a lower heat than that to which as shown above they would be subjected in a loaf of bread, and as no cases of infection have ever been traced to the loaf, it is difficult to say why a loaf should be made the cause of attack as far as it concerns the baker, because even although there were said to be ten different kinds of germs found in the middle of a loaf, these germs are far more likely to get in from the air in increasing quantities after the loaf has left the baker, the same as all other foods are bound to be contaminated by the air; and if the bread was absolutely sterilised in the oven, the slices of bread and butter on the table would in common with all other foods be found to have again attracted an increased quantity of the 70,000 germs that are said to settle on every square foot per hour in any crowded room.

Regarding brown bread the popular practice is to give a cooler oven, or place the loaves in the coolest part, and longer time for baking. There is no reason, however, that this should be necessary, except that people for this class of bread usually add an excess of water. The adding of the water in this excess has no advantage since it must be driven off unless the loaf is to be clammy in the centre, and, on the other hand, has the disadvantage of making a thick and tough crust, which is quite unnecessary. Although it may be desirable to put more water when making the dough, so that the bran may be thoroughly saturated, the brown dough when being scaled should not be slopped on the scale-pan like porridge, but be very little slacker than an ordinary proper tin dough, which, however, should be, of course, slacker than a cottage. The quick baking of brown bread is as desirable as fermenting it quickly, and, if anything, should be more quickly baked than white rather than the reverse; and it is frequently found that those put nearest the furnace are the best, and brown loaves do not burn so quickly as white. Inasmuch as brown loaves have necessarily less gluten than white, it is particularly desirable that the gas therein, and all the expansive properties, should be expanded to their utmost as quickly as possible, and, also, as there are more impurities and more soluble albuminoids, it is particularly necessary in the interests of flavour that the baking should not only be quick but thorough.

STEAM

STEAM is an invisible elastic gas evolved from water during boiling, and becomes visible only when condensing by coming in contact with colder surfaces. The steam required for glazing and blooming bread must be wet steam and not dry; and steam that is under a high pressure, thereby becoming superheated, is dry, and not wet. This is the reason that hot steam does not burn so much as cooler steam. The steam issuing from a kettle, which, at the ordinary atmospheric pressure, is at a temperature of 212 degs. F., will burn or scald the hand very much more than steam issuing from a high-pressure boiler which might be three or four times as hot as the kettle steam. The reason is extremely interesting.

The steam from a kettle is of the same temperature as the boiling water. Yet, as boiling water requires a very long application of heat before it is all turned into steam, and as, by the fundamental law of

Section of Coburg Loaf.

(ACTUAL SIZE.)

chemistry, nothing is destroyed, it is obvious this heat, going into the boiling water, is still somewhere, and can be re-obtained. It is in the steam; it is temporarily employed, or apparently consumed by the difference in the state of matter, water being a liquid, and the steam a gas. The steam, therefore, although showing the same temperature by the thermometer as the water, contains a very much larger quantity of heat, and this is proved by the fact that one can quickly raise a bucket of cold water to the boiling point by injecting steam into it. When thus made to boil, the water will weigh a very little more, or the bucket be a very little fuller, than before, but if one were to add three or four buckets of boiling water to the original water, it would not boil then. The amount of heat in steam that is thus latent, or thus temporarily lost, is 966 degs., when at ordinary atmospheric pressure. But when at higher pressure, this amount of latent heat curiously decreases, even to the extent of 150 to 200 degs. It is seen, then, that steam issuing from a high-pressure boiler has to get from somewhere the amount of latent heat that is necessary for it when in the open air, and when absorbing this heat, although it does so very quickly, it is obvious it is not in such a ready position to burn and to scald as the wetter steam.

Steam, then, that is required for injecting into an oven must not be allowed to become superheated by reason of the pressure in the boiler becoming great. It must be low-pressure steam, wet steam, and steam with a high latent heat. The difference in the scalding of wet steam and dry steam, may also be understood by remembering that a man can get into the oven to repair it—that is, into a dry heat—when at a temperature of, say, 212 degs. F., but he could not get into a bath of water—that is, into a wet heat—at this temperature, which is the boiling point. Also the steam escaping from compression in the boiler immediately, but momentarily of course, expands, and anything that expands absorbs rather than evolves heat in so doing. When water is boiling under increased pressure, and steam is at a higher temperature than 212 degs. F., the latent heat of the latter proportionately decreases, according to the following table, which also supplies information concerning steam-pipe ovens.

Latent Heat. (Degrees Fah.)	Thermometric Heat.		Total Heat. (Degrees Fah.)	Pressure.
	(Deg. F.)	(Deg. C.)		
1,092	32	0	1,124	0
966	212	100	1,178	14.7 lbs.
836	392	200	1,228	228.0 ,,
769	482	250	1,251	550.0 ,,
766	500	260	1,266	617.0 ,,

This latent heat is of considerable importance to users of steam, because, on its account, a pound of steam contains about five and a half times as much heat as a pound of the boiling water from which it is coming, although both steam and water will be of the same temperature. In other words, when a pot of water is on a burner, which is giving off the same heat all the time, it will take over five times longer to convert that quantity of water into steam than it did to raise the same from freezing to boiling point, that is, through 180 degs., and the extra heat in the steam will always be given out again when the steam recondenses into water. Steam going into the oven at 30 lbs. pressure, namely, at twice the pressure of the air on an open pot or kettle, that is, at two atmospheres, would have a temperature of 250 degs. F.; this would therefore cool down an oven that was at a baking heat of 450, requiring the oven to be hotter, in first place, if steam was to be injected, but if the steam was to be obtained from a pot put into the oven, one can easily see that a great deal more heat would be taken from the oven to convert that water into steam than is usually contemplated. The pot would have the advantage of producing wet steam, whereas at about 100 degs. above the usual boiling point the steam would be quite dry and not suitable for glazing.

When having a steam boiler it is therefore essential that the pressure be as low as possible, that is, only just sufficient to get enough steam into the oven. The smaller the boiler the greater, of course, must be the pressure to get enough, because if, for instance, 10 feet of steam were required the boiler must contain that 10 feet, but if the boiler is only 5 feet, the steam must obviously be compressed to half its natural size, and so on. As a general rule, it would be best to keep the pressure in one's boiler from 25 to 30 lbs., or less, if possible. In order to prevent it getting above this, one can have fitted to the boiler a blow-off, or reducing, valve, whereby an excess would automatically be released.

Regarding the amount of steam necessary to retain in the oven, a little calculation would be interesting. A sack batch of, say, 200 loaves would give off about 2 ozs. water per loaf, or 400 ozs. An ounce of water equals 28.35 grams, and therefore 28.35 c.c. (cubic centimetres). A cubic inch (16.38 c.c.) of water expands into a cubic foot, or 1728 cubic inches of steam; and the cubic space of the oven to be filled would be the height multiplied by the length and then the breadth and minus the space occupied by the bread.

As regards glazing or blooming the crust, it is essential for the steam to be present when the loaves are first set, whereby it condenses on their cold surfaces, because no amount of steam will glaze a loaf when once its surface is dry. On this account, one sees in France and Vienna long narrow baskets lined with a cloth, on which the loaves are turned upside down when proving, whereby they are kept much moister than otherwise. The thorough saturation of the air of the oven—and the hotter the oven, the more it will absorb without becoming visible—will tend to lessen evaporation from the bread; but it is possible, for some purposes, to have an excess of steam, as too much not only keeps the loaf down, preventing it expanding as it should, but also caramelises the top of loaf too much, preventing the crack and finish desired, especially for small bread. The cuts on the loaf do not open if caught too much by the steam. Too much will also leave the crust tough, unless the loaves be moved about and turned over, which is a common practice, so as to thoroughly dry the crust before being drawn. If, on the other hand, there is too little, the crust dries too much, all other things being equal, is duller, less bloomy and less appetising, harder and less crisp, is more "corky" and less pliable, and also more likely to be nipped or burnt by a fierce or rash oven.

A boiler is a most handy thing, and a good investment in the bakery in more than one respect, but, where crust gloss is essential and one has no boiler, loaves can be washed or sprinkled and placed on a baking plate and covered over, say, with quartern tins, or can be placed in box tins and then uncovered before being drawn and put back to finish. Some put iron upsets filled with wet ashes just round the furnace or hottest parts of oven, and arrange the dampers so that the steam is drawn by draught over the loaves. Coils of perforated pipes have often been inserted in the hottest part of oven, or even a straight pipe running down both sides. The objections are that the pipes become choked in the same way as a kettle or boiler gets furred by the deposits from the water, and also too much water is often allowed to run in, and therefore, not evaporating into steam, drips in the oven or on to the goods. A nice gloss, altogether better than washing with water or anything else, can also be obtained by proving in steam before setting.

Referring to the pressure on the loaves of steam in the oven, we remember seeing a very novel, so-called, vacuum oven, from which the air, and also the steam as it came from the bread, was extracted; the decrease in pressure was so great that the loaves rose without having been fermented or injected with gas, and were cooked at a lower temperature, water boiling in a vacuum at about 70 degs. F. The flavour of the bread for a change was delicious. This is described in the chapter on ovens.

YIELD OF BREAD PER SACK OF FLOUR

THIS is an exceedingly contentious point. If the question were put to ten well-informed, intelligent and observant bakers who were actively working in, or superintending their manufacturing daily, they would give almost as many different answers. We have been writing on and discussing and closely arguing the matter for nearly twenty years, and yet it would be dangerous and misleading to give a definite statement in a few words. The fact is, no answer to suit all circumstances can be given. The same flour does not always produce the same amount even in the same bakery, or even on the same day, or, still further, even in the same batch or ovenful of bread, and it certainly does not always produce the same in different bakeries. It is a case governed by differences in the system of fermentation, differences in the amount of water added and the slackness of dough and manipulation, differences in the quality of the flour, differences in ingredients added, differences in the heat of the oven and the time of baking, and also even in the particular position of the various loaves in the same oven.

We once stated in the *British Baker* that a certain Scotch firm had said, and showed us their books confirming, that they produced when using 9 lbs. of salt per sack, an average yield, extending over six months, of 100 quarterns per 280 lbs. of flour, and this led to a large amount of conflicting correspondence. We have also before us a circular on a system of bread-making, "by which 110 to 112 loaves of 4 lbs. each can be obtained from country-milled flours, larger yield from strong flours." The author of that circular further says that country milled flour by ordinary methods will turn out 98 4-lb. loaves. We have also an article before us that tabulates "the result of twelve trial bakings that were made in 1897 by friends who are skilled in the art of bread-making," and the variations are from 87¼ up to 110 quarterns per sack (always 280 lbs., unless otherwise stated). Although they are statements in print, and technical journals, and presumably should be fairly accurate before getting there, we ourselves cannot swallow them without qualification. We are in constant touch, both by visits, and also more frequently by correspondence, with almost all the well-known large factories of Great Britain and Ireland, and even abroad, and the factories will never admit (and this is confirmed by one of the greatest authorities in Scotland, with whom we are often in touch, and who has had special facilities concerning this point) more than 96 quarterns per sack for the square crumby bread. This yield means, after due allowance for evaporation, about 15 gallons, or 150 lbs. water added to the 280 lbs. flour. Although some flours, and some loaves from the same flour, retain more weight than others, the great factor in yield per sack of flour must be the amount of water put into it and retained.

Dealing first with the above Scotch case, it should be noted that some firms will make the square crumby, the French and the pan all off the same dough, that is, the pieces are all scaled off at the same weight, and then, when the batch is being moulded, the foreman would direct how many loaves of the various shapes he required; the yield for each shape would, where such a proceeding prevailed, be the same, that is, commercially, there would be the same number of loaves sold as 2 lbs. or 4 lbs The French dough, however, would often be tightened up, that is more flour would be put into it after it was first made, therefore yield less; and, on the other hand, it would be in the oven less time, and therefore lose less in weight; it would have most circumference of crust, but less thickness of crust top and bottom. Other firms would scale the French at 4 lbs. in the dough, while they would scale the squares at 4 lbs. 6 ozs., or 4 lbs. 5 ozs., and would thereby say they got more out of the French, say they had 101, or something like that. Many firms would make separate and slack doughs for pans; they would get as much as 17 gallons, or 170 lbs., of water into them, and then also usually scale into the oven at less weight and draw them quickly, whereby losing less during baking. Some loaves lose only 2 ozs. on the 2 lbs.; others lose 4 ozs. on 2 lbs., and if a man was going to bake well, he would weigh in half-quarterns at 2 lbs. 3 ozs. each, but he would weigh a quartern at probably 4 lbs. 5 ozs., or less than double, and would thus save if baking all quarterns. We very seldom get a cottage loaf—do sometimes—from Scotland, it being chiefly an English and Welsh variety. By reason of shape, such have to be tighter, that is, have more flour and less water, therefore less loaves to the sack than pan or tin bread.

Here also the amount varies very much. If a man puts shops under management, the usual rule of the trade in London is to expect the manager to produce and account for 92 quarterns, all kinds included, for every sack of flour supplied him. In Bristol the association has recently adopted 93 as a fair amount for official purposes. The amount of water used on an average in practice daily to a sack of flour as met with in our experience varies from 13 to 18 gallons, that is (130 + 280 =) 410 lbs., and (180 + 280 =) 460 lbs., of dough. There will be about 10 lbs. of this lost during fermentation, but then there will be yeast, salt, cones, and flour for dusting, and, perhaps, other ingredients that will replace most, if not all, of that. This weight of dough weighed into pieces of 4 lbs. 6 ozs. for the 4-lb. baked loaf, will produce about 91 and 104 quarterns respectively.

In addition to the various causes of variations in the yield which we have already mentioned above, there are others, such as the effect of sifting, getting all out of the sack that there is in it, also such as a mouse-hole in the sack that lets out a certain amount of flour every time the package is moved, also evaporation of water, not only from the bread, but from the flour when stored over the oven, and other circumstances. One often hears of big yields when a man is counting his loaves, which he weighed in the dough at, say, 2 lbs. 1 oz., and not reckoning baked bread; but only last week two men in different parts of the country, each referring to a particular grade of flour, a different brand in each case, declared that a test gave them only 80 quarterns per usual sack. As a guide, then, to a man estimating profits for full-weight bread, he should reckon on the average in a mixed trade not more than 96 for the three Scotch sorts referred to, or not more than 94 for the English cottage, and, in many cases, depending on all the circumstances above mentioned, he will get less.

Out of a vast amount of correspondence personally received on this point, one letter from the Midlands mentions an ascertained yield of 25 stone, or 100 quarterns per sack, by adding 3 lbs. of scalded material, as already discussed in these columns, without which the correspondent could get only 94. That is, when he omitted the 3 lbs. of scalded material, he got 6 quarterns (or 12 half-quarterns weighed at 2 lbs. 3 ozs.) less in consequence. Chemistry tells us definitely that matter is indestructible, but in these days it apparently, if the above could be proved, can be created. Another correspondent, making a test, found 94 quarterns cottage. Another English firm, doing a large good-class family trade, found their average, for all sorts over a period, to be 95 quarterns out of the bakery for every sack of flour sent in; the loaves were always scaled by machine at 2 lbs. 2 ozs., baked in modern steam ovens, with regular crust, and found good weight when cool. Another similar good-class firm found 94 to be the average for all sorts produced, highest-class flour being always used, and cottages weighed in at 2 lbs. 3½ ozs. A Belfast correspondent says he finds 96 a good average, with 98 as a maximum, and that an authority he consulted said 94 would be fair average to count, while Glasgow would, he said, get a little more because of lighter doughs and stronger flours. A Dublin correspondent, who is undoubtedly careful, calculating, and intelligent, says with his tight doughs he cannot average more than 89, and tries for 90

We have also received some carefully prepared figures concerning an accurately made test, where a sack of flour, to which was added a fraction over 31 lbs. (thirty-one pounds) of other materials, consisting of salt, yeast, corn-meal, lard, malt extract, and sugar, produced just over 137 quarterns (one hundred and thirty-seven) per sack, nearly 25½ gallons of water being added. This extraordinary yield will be jokingly styled by our readers as "American," but the document setting it forth was prepared in detail and signed and sworn to before a commissioner of oaths by three prominent men as having been seen by them, and carefully watched throughout every stage of the process as therein described. Every precaution was taken to prevent mistake, and irrespective of our knowing, and having accepted engagements from the persons interested in the invention that was being tested, it must be admitted that anyone is far more careful in signing and taking an oath on a matter than in giving a mere and casual expression of opinion, yet this tremendous figure of 137 quarterns per sack of 280 lbs. came under our notice in the same week as two others of 80 quarterns. It certainly seems impossible to reconcile them.

By a considerable amount of acquaintance with other American methods we have found a fairly high yield to be 280 lbs. bread to the barrel of 196 lbs. flour, and exceptionally 300 lbs., which would be respectively 100 and 107 quarterns per sack of 280 lbs. As in all places where there is much home baking, the bread there is more usually baked in tins than in the British Isles, taken as a whole. At this moment we have before us an advertisement concerning a London made flour that is said to produce 100 quarterns per sack against 95 obtained by the usual mixture; also a report of an expert on a Minnesota (American Spring) patent certifying 102 to 108 quarterns; also figures concerning a Vienna flour showing 108 to 112 quarterns. In France much of the bread contains more water than ours, having a quart or 2½ lbs. of water to 3½ lbs. of flour; yet the great majority of bread in England, of which the cottage loaf is a leading type, has its dough made from only half its weight of water, namely, 14 gallons, or 140 lbs., per 280 lbs. flour. Where cottage bread is the rule, the tins are usually, especially in small trades, made from the same dough, and therefore contain the same medium quantity of water; but in the more northern parts of England, such as Hull and Manchester district, there is a greater preponderance, and, in cases, almost exclusive use of tin bread; the doughs then are very slack, 16 gallons per sack being very common, and 18 occasionally. The other extreme, namely, of 13 gallons to the sack, has usually been from the South of Ireland, the doughs of North Ireland being slacker, and those of Scotland for similar bread being slacker still.

There are still other points of importance. There can be no big yield without the water being added, but it is equally important that fermentation, manipulation, and quality of ingredients should be in accordance. The way in which some of the water is lost or evaporated has already been discussed under the heads of dryness and baking. Gluten, some of the characteristics of which have also been explained, has undoubtedly an influence on yield. Mere quantity of gluten is not a safe basis on which to calculate, because there are wide differences in the character of flours and glutens, and also, as in the case of volume, much depends on manipulation. A Hungarian patent flour with a smaller percentage of gluten than an American low grade, will usually give the more bread. Also, some flours with an excess of gluten are worse retainers of water than a more evenly balanced one of the same class. As a rule, however, a larger proportion of the right sort of gluten will enable a bigger volume to be obtained, and the bigger the loaf the more water it will carry without showing it. A flour with a larger proportion of gluten is also usually more stable, and can thus be made up slacker without "giving" or falling off so much in trough or on the boards. Where the gluten is composed of too much gliadin, it will, like starch, take the water, but afterwards "give," whereas, if containing the right proportion of glutenin, it may take less, but retain it. The importance of the correct percentage of these constituents which decide the quality of the gluten has already been discussed, but it may be mentioned here that a certain patented process that aims at adjusting these two, claims to gain 1 lb. of flour in every gallon of liquor used.

It has been found that decreasing the gluten by adding starch artificially has decreased the yield, and also that increasing the proportion of gluten by washing out some of the starch has increased the yield. Some few years ago the author obtained from some starch manufacturers a quantity of gluten, which to them is a by-product, and usually sold, as said by them at the time, for use in cattle food, but, doubtless, also ground up into so-called gluten flour; but the results of adding this to white flour had very little effect on yield.

The effect of manipulation is easily seen by the fact that one can always get a larger yield, in proportion, with a small test than with the usual commercial batch. This circumstance often accounts for discrepancies and erroneous conclusions. As a rule, with the same amount of labour, a loaf blown up quickly by a short, quick, and vigorous process, provided it be ripe, will hold more water and handle more easily with the extra amount than a long slow one. A ripe dough will carry more than an unripe one. The gas in the one case, and the labour and ripeness in the other, tends to volume, with the effect as explained above. The abundance of gas to some extent in a quick process supplies what is not obtained in a long steady process, unless the latter has been well divided into stages and extra skilfully manipulated, so that its gluten is developed to the utmost of its elasticity, and well stretched and folded. The latter is the case in Scotland, and big yields out of comparatively soft flour are in a similar way obtained in France. There is a very great deal in this manipulation of the gluten and the way in which the flour is worked into the water, and often accounts for apparent discrepancies in yield between long and short process.

We have closely watched results from different machines. Both in fancy and in ordinary bread we have found less flour required to make a dough, therefore a better yield, when added by instalments and worked in by gradual kneading, instead of all at once at the start, and by grinding more. By adding gradually where the machine gives a good stretching action, the flour is enabled to take all the water it will. It may be argued, with reason, that once the right amount of flour is discovered, that it could be weighed and added in first place, but, except in large and exceptionally well-managed bakeries, this is not the rule, and the consequence is that generally more flour is added than necessary, and the machine will force it in. We know where the same flour sent to two depots, one having machinery and the other not, gives more yield in the latter case, but it is no fault of the machine. Also, in the same bakery two different machines were each given a week's close test under the same conditions throughout, the one that took twice as long as the other to make the dough, enabled the latter to recover and be ready for scaling sooner, and made the better yield per sack. As there are interests involved, we cannot here state the case any more plainly. Sifting machines, by enabling the sacks to be more completely emptied without risks, and by loosening the flour and breaking any lumps, are a benefit to yield. There should be less dry lumps, and less flour not thoroughly saturated, when using machinery.

While dough is fermenting there is evaporation of moisture and also evolution of gas, therefore decrease in weight. The gas is made out of sugar, and the loss of dry matter in medium processes amounts to about the same as the percentage of natural sugar in flour, namely, rather over 2 per cent., or, approximately, 6 lbs. per sack, in addition to moisture evaporation. This is what we wrote in the *British Baker* ten years ago, but we see Professor Snyder of the Minnesota Agricultural College says he found the loss of dry matter to be 1¾ per cent., or about 4 lbs. flour per sack in a short process of four hours from start to oven, and 8 per cent., or 20 lbs., in a process of twelve hours, that is, five times the loss in treble the time; also loss of nitrogen was nearly four times as much, namely, two against 7.7 per cent., especially in small tests. The 20 lbs. per sack is rather a startling amount, and sets one thinking with renewed energy about quick processes. The author recently made two batches of two sacks each, all quantities, of course, carefully weighed. One was by long sponge, and the other by quick off-hand dough. At throwing-out time the dough that had been preceded by a sponge was much the slacker, and had to have other flour added in order to make it of the same workable consistency as the off-hand dough. The fine bulky and light tin loaves of some districts that are made from such extra slack and quick doughs with large quantities of yeast, would not, without altering the whole character of the bread, be ærated sufficiently quickly at the finish to stand up or hold in suspension so much water if they were made from a slow process with less yeast. Such loaves are lighter and more spongy than the good volumed loaves of Scotland, yet are made from softer flours.

Regarding the adding of materials such as malt extract and potatoes, their chief effect must be their influence, according to conditions, on the vitality of the fermentation, as just seen in the case of quantity of yeast. They do not contain much solid material, and increase the weight of the dough chiefly by their water, which could be otherwise added. Carbonate of lime used to be added, because it increased the yield by checking diastasis or change of the constituents of the flour that were already somewhat unstable; and in damp seasons malt extract and the changed starch of the scalded potato must increase instead of check this diastasis: the two actions are therefore contradictory, except as showing, as instanced above, that yield depends, like volume and other things, on the regulation of the changes in the flour by process and by manipulation, by just the right amount of change, neither more nor less, and the presence of a copious amount of gas when the loaf is just about to be baked.

It is thus obvious that the increasing or decreasing of the changes can be advantageous or disadvantageous, according to individual circumstances, and that no absolute rule should be stated. The addition of scalded flour or other scalded materials comes within the same category. This is already dealt with under its own heading in Section I., and also under colour and other points that it affects. The water is certainly better entangled when adding scalded flour or starch than when adding extra starch in a raw state; it enters into the composition of the more soluble matter and therefore is less easily evaporated: if therefore retained it must increase the weight and yield, although the weight, with a large amount of scalded matter, will often be found when handling the loaf by reason of its usually decreased volume. Having elsewhere given instances of our own concerning amounts with varying effects, we will here mention some trials by Mr Vass, who found that adding 20 lbs. of scalded rice, in place of flour, to a sack of strong American patents produced a total yield of 108 quarterns, and adding 12½ lbs. to a sack of English patents produced 100 quarterns. Moisture, which may amount to nearly half a gallon per sack, that is, evaporated from flour kept in a moderately warm place, such, for instance, in a store over an oven, will be reabsorbed if added when making the bread. Also, on the other hand, when wheat is washed or damped, which would usually be done only in the case of hard wheats for the purpose of cleaning and more easily removing the outsides, the yield would not be appreciably decreased. Weather during milling affects the yield of flour from wheat. Some countries weigh their flour light so as to allow for moisture absorption during transit.

There is just one other point, namely, that, even if yield was the sole criterion of value of flour, which it is not, the extra number of quarterns obtained should not be reckoned at their price when sold. In a certain prize essay on the relative merits of home milled and foreign flours, we see it stated that the difference in value between a flour producing 96 quarterns and one producing 93 is 1s. 6d. when the price is 6d. per quartern. That is bad arithmetic, which is unfortunate in an otherwise excellent essay. If 3 quarterns extra made the sack of flour worth extra at the rate of 6d. each, the sack that produced 96 would be worth 48s., but the price of it is given at 28s. 6d. The calculation is really one of proportion, namely, if 93 are worth 28s. 6d., how much are 96 worth.

$$\text{As } 93 : 96 :: 28\text{s. } 6\text{d.}$$

$$\frac{96 \times 57}{93 \times 2} = 29\text{s. } 5\text{d.}$$

This is seen to be less than two-thirds of the increase claimed. It is sometimes argued that the extra 3 costs nothing extra for labour and selling, etc., but this does not alter the fact that they should be considered only in strict proportion to the others, because if they were not wanted, if they did not supply some customer who would otherwise be supplied from the same source, they would, of course, be unsold, and therefore worth nothing. The point is that the making of them does not necessarily sell them. If not accepting the principle of proportion, which cannot, however, fail to be wrong, one has only to multiply the result to see the full force. Three quarterns per sack would be, on 100 sacks, 300 quarterns, and surely these would cost something. Extra trade with the same fixed expenses decreases cost of the whole, but extra production without the trade does not. The above fact is so very often overlooked, or would be explained in less space. An advertisement before us, although announcing flours that we have favourably reported upon, claims 100 quarterns for a certain sack of flour against 95 as supplied by other people, which also claims to reduce the cost of sack to extent of 2s. 1d. for 5 quarterns at 5d. If, however, the amount of flour in 100 costs 25s., that in 95 will cost about 5 per cent. less of 25s., namely, 1s. 3d.

SECTION V

MACHINERY, APPLIANCES, OVENS, FIRING, DRAUGHT, AND VENTILATION

"Our doubts are traitors,
And make us lose the good we oft might win
By fearing to attempt."

MACHINERY

AT one time it was very frequently stated, and very popularly believed, that machinery in the bakehouse did not pay with a trade of less than forty sacks (280 lbs.) of flour per week. We have always entirely disagreed with this, and can point to many such installations which have abundantly satisfied the possessors beyond their expectations, and fully recouped the outlay. Some will admit the advantages with a trade of twenty-five sacks, but we will go further than this and state, according to personal experience, that machinery, when suitably selected, can be made to pay in any business, properly organised and adjusted, that at present returns a normal commercial profit on capital and labour. We have before us a quotation from *The Baker's Helper* of Chicago, America, which says that machinery pays for a trade of 12 to 14 barrels weekly ($8\frac{1}{2}$ to 10 sacks of 280 lbs.), and that "in a shop using from 20 to 25 barrels of flour per week it will save the labour and hire of one man."

The selection of the machinery, and the organisation and adjustment of

A NOTCHED FANCY BRICK.

manufacturing and trading conditions to it, are really more important than the size of trade, because one man, with a trade of the same size, and even the same price, will be successful where another fails. There are instances where machinery does not pay because it has been selected of an altogether too elaborate, and expensive, and unsuitable character in proportion to the existing and prospective size and character of the business. There are other instances where people discard machinery, because they attempt to continue exactly in the old rut, forgetting that a machine is a machine, and that one of its chief advantages, namely, uniformity, must not be supposed to adapt itself to varying conditions, but that, when once a machine has been selected as nearly as possible in accordance with requirements, other conditions must be altered to fit.

Close observation will show that the bakery trade is now advancing very rapidly; the revolution will undoubtedly be greater than in the sister trade of milling, and in that revolution, which this year is receiving great impetus, the part played by machinery is destined to be very considerable. Quite a few years witnessed the great change at enormous outlay from stone to roller milling; prejudice there, as in most changes, ruled for a long time. The unbelievers lagged behind, but had to spend their money just the same later when some of their trade had gone to their more progressive competitors, and they then found it more difficult to get back their own trade than, had they been first, it would have been to get that of others. It will be the same in the bakery trade, and the first man in a district to judiciously bring himself up to date in all his methods will pay for his plant by increased trade while others are in contemplation.

Machinery in the bakehouse is now to some extent looked upon by many as merely a great convenience or a luxury, but it is very rapidly becoming a necessity, and while now machinery is the exception, it must very shortly be the rule, and no one can afford to ignore the undoubted tendency of the times. Legislation, conditions of labour, public sentiment, quicker methods of fermentation, desire for improved quality, competition, improvements in construction, and a greater selection in kinds and prices of machinery, all tend to the increasing adoption of the latter. While, however, the large variety of machines on the market enables one to say that all classes of users can be satisfied, the variety, immediately one travels or looks into the question, is such as to cause bewilderment, which is often increased by the natural propensity of every manufacturer to believe his own production to be just the very one required. Intending buyers, who very often buy their experience dearly, would therefore usually be well repaid by consulting some independent authority, who they knew to have not only a practical knowledge of the bread-making business, but also a full acquaintance with the good and bad points and suitability to their case, or otherwise, of the various appliances in question.

The larger and more complete plants, such as already adopted by most large firms, are greater savers of labour and waste, and usually more durable than the smaller and less expensive, but the latter have recently been brought to greater perfection than formerly. In many cases, therefore, a sum of less than £100 has been expended with the good result of saving the men the exhausting work of dough-making, making them more contented with their situation, reserving their energies, both physical and mental, for other important stages of the manufacture, improving the quality, and increasing the trade with no further expense.

When considering motive power, the steam engine, although employed in some large bread factories, may be dismissed as too expensive for the ordinary bakery, the choice being between gas and oil engines and electric motors. A gas engine is a heat engine in which the working fluid is atmospheric air, and the fuel an inflammable gas or vapour. The fuel is introduced directly into the cylinder and burnt there, instead of in a separate furnace as in the case of a steam engine. One of the best known types is that invented by Dr Otto, which has been invented less than thirty years, and is now made by many firms at different prices, an Otto engine not always being the same in details of construction. There are three distinct types of gas engines, but we need consider only one. In this the cycle of operations consists of charging the cylinder with gas and air mixture at atmospheric pressure, then compressing into combustion space, then explosion of the mixture, then expansion after explosion, and finally expulsion of the used charge. There is usually one impulse given to the piston in every two revolutions. Piston on forward stroke draws in the gas and air mixture, on backward stroke compresses it; the latter is then fired by the coming in contact with the red hot or ignition tube at end of cylinder, sending piston forward. The governor regulates by shutting off gas, and thus causing explosions to be missed when the load is light and engine running too fast. The gas engine converts a far larger proportion of heat given it into work than any steam engine. The light oil engines of motor cars are practically gas engines. A unit of heat supplied to a gas engine in the form of coal gas is more costly than that supplied by coal, therefore a gas engine using ordinary gas is at a disadvantage for large powers, of, say, over 20 H.P. (horse-power), and thus one finds some flour mills, and such larger factories, make their own gas on the well-known Dowson principle. This making of power, or heating, or producer gas will presently be referred to for heating ovens.

When proceeding to start the engine the card of instructions usually supplied should be carefully read. First, see that belts are on the loose pulleys, then light ignition tube, and then oil the bearings, etc. See that cooling water for the cylinder jacket is all right, the tank being full and the flow not impeded. Sometimes the exhaust pipe wants emptying, because of condensation of gases producing water in it. In about ten minutes from lighting, the ignition tube will be red hot, then put exhaust lever to right, lift governor temporarily, and turn on main supply of gas, give fly-wheel a few turns until an explosion occurs, push exhaust lever back, and engine should then be running properly. In stopping, the reverse would be necessary. It is necessary to see that the burner burns with a blue and not a luminous flame; if the latter, it has lighted back, and should be turned out and relighted. Great damage would be done to piston if not well oiled. The water jacket round cylinder should always keep the latter sufficiently cool so as to just bear the hand on it, and the water tank should be as high as possible, with as few angles as possible in the connecting pipes. Sometimes these pipes get choked by accumulations of rubbish in tank and cause a stoppage. The valves must occasionally be examined to see they freely open and shut without any clogging by dirt, etc. The explosion with average work should not be at every stroke, and if so, the gas, which needs a different proportion to air, according to quality, probably wants regulating, or, perhaps, the exhaust valve is leaking and wants cleaning or resetting.

In some districts the usual gas cannot be obtained, and the amount required for the engine is too small to warrant erecting a Dowson or other plant for making it on the premises. There are some good oil engines to supply the gap. These, although dating from the first practicable one made in 1870, and about six years before the Otto already referred to, have not been so quickly or easily perfected to overcome all difficulties as the gas engines, especially in the larger powers. Considerable advances have, however, been made recently in connection with motor vehicles, which chiefly monopolise their use in this country, but in America and other countries where gas is scarcer and dearer, there are many light oil engines for fixed or stationary use. Oil engines are really explosive gas engines of the ordinary Otto type, with special arrangements to enable them to vaporise the oil to be used, the oil engine, when the petroleum with which it is fed is converted to vapour, being practically the same as a gas engine. This is proved by the fact that many engines can very cheaply be converted from one to the other by merely adding or removing the vaporiser and a few sundries, which is a great convenience in districts and countries where villages quickly become towns. There are at least three distinct types, namely, (1) where the oil is subjected to a spraying operation—like a scent spray—before vaporisation, as is done in the Priestman type, which is the most general; (2) where the oil is injected into cylinder and vaporised there; and (3) where the oil is vaporised outside the cylinder and introduced in a state of vapour. They might also be divided by the method of ignition, or lighting the oil, which is adopted, namely, whether by electrical spark, incandescent tube, or other methods. The supply of oil wants regulating for the purpose of even working and explosion in the same way as gas.

The vaporiser must not be too cold or too hot, as in the one case it will not provide sufficient vapour or gas, and, in the other, not in the right condition. The amount of air admitted should not be much at the start, but should be increased later. The exhaust, when the engine is doing an average amount of work, should be almost invisible and contain no soot, which would finally clog the parts. The ignition tube requires cleaning occasionally, and the valves and other things require similar attention, as already mentioned concerning the gas engine.

Electric motors are the most convenient form of power, but, depending on the size and amount of use, they are usually, at present, more expensive to run than gas engines. They, of course, occupy very little space, a 6 H.P. (horse-power) motor going into a box of about 7 or 8 cubic feet, or less than 3 feet at its longest side, and not requiring floor space or a separate glass partitioned house, and, in fact, it can go into the space otherwise occupied by the water tank necessary for cooling the gas engine cylinder. There is, of course, no exhaust to silence, no turning of fly-wheel, no waiting for ignition tube to heat, no back firing, less noise, no smell, and, when attached to each machine, no shafting or belting. This attaching to separate machines is particularly handy for knocking up during the day a small mixture of cakes or sponge goods, instead of more laboriously and less perfectly turning the usual hand machine, or instead of running all the time the heavier engine and shafting that was designed for the bread or night work. Where trade, as in many cases, has increased through adding machinery, and as the advantages of some machines were found, others were added, and thereby sufficient of them running at same time to overtax the engine, these motors are also very handy. The success of them depends, of course, on the power and character of the current supplied from the main, and although successful in some cases, they are not always so where the current is alternating, and investigation is required. We know very many instances where entire satisfaction is given, and their number will certainly increase.

The cost of engines varies according to the makers, but the prices of gas, oil, and electric, as supplied by a certain well-known firm, compare as follows. The gas engines, including water tank, spanners, etc., can be obtained in almost any size, a 2¾ brake H.P. costing £32, a 12 H.P. costing £106, with fairly proportionate intermediate prices in intermediate sizes. The oil engines of ¾, 3, and 12 H.P. cost respectively £32, £70, and £160. The electric motors, including starting resistance, of 2, 3, and 10 H.P. cost respectively £40, £56, and £111. Taking for purpose of comparison an engine of 4 H.P., it will be found that the gas, oil, and electric cost respectively about £43, £80, and £67. There is then the question of running. The smaller gas engines consume 20 to 25 cubic feet of gas per brake horse-power per hour, and the larger, about 16 to 17 cubic feet, the proportions of gas being, according to quality, about one part gas to every ten or twelve parts of air. The cost can be reckoned out from these figures, according to the varying price of gas in various districts, and an actual instance before us is of a 3 H.P. engine (brake or effective horse-power is always meant) making three to four sacks of dough and sundries daily, at a cost of 3s. 8d. per week. Other light machines have been run by a 4 H.P. engine throughout the week, at an average of about 2d. per hour of working. It has been stated, in a prize essay, by a Glasgow writer that in his factory 4800 dozen loaves (100 men at 48 dozen each) per day can be made at a cost, for steam power, of little over 5s. per day, the driven plant for his particular squad costing £487 and taking 25 H.P. Regarding oil, the consumption in small engines is about 1 lb. per brake horse-power per hour. A small engine has been run with oil at 6d. per gallon for 1½d. per horse-power for three hours, or ½d. per horse-power per hour. Electric motors are supplied in some towns with current at 2d. per unit, and in others at 3d. and more; at the former price the cost is about 1½d. per hour for a 6 H.P. motor, but this can be ascertained easily by each individual for himself. An instance is before us of a 6 H.P. motor making five sacks of dough with one unit at 3d., where the main current was alternating.

Machine kneaders will do better in six or eight minutes or less, if required, that which will take two men fully twice or three times as long. In larger bakeries with two kneaders, one man can do in less than half the time more than double the amount of six men. In smaller bakeries, where the plant requires as much cleaning and keeping in order for one batch as for ten, and where a minimum number of hands must be kept for other purposes, there is in point of wages, no immediate saving. The work, however, can be done in less time, and with less fatigue, and it would be an exceptional business if the increased mental vigour for thinking of improvements, and the saving of time could not be shortly afterwards turned to profitable account, even if it did no more than save a jobber on a Friday night or at other busy season. Those engineers who want business have illustrated their machines in the advertising pages of this book, and also place them on view at the annual exhibitions; it will, therefore, not be necessary to describe any particular machine, nor is it expedient in connection with the various types to give an opinion in print.

Points to examine are the efficiency as judged by the finished dough; the durability as judged by the general construction, and particularly the bearings of the shafts or blades, the wear and tear and liability to leakage being, of course, greater where two revolve on one axis, especially in opposite directions, or where the bearings are narrow. Accessibility for cleaning, filling and emptying, space, capacity, compactness, power taken, coverings to prevent waste, etc., are all points needing consideration, according to individual circumstances. The action on the dough should certainly be stretching rather than cutting, but the best machine is not necessarily the one, as some seem to argue, that most closely represents the action of hand kneading. The best motor car is not the one that imitates the action of a horse's legs, and a circle cannot be drawn better by hand than by a compass. The test is to look at the dough when finished, and, if that is satisfactory, it matters not whether it is made by one, two, or three blades, or, in some cases, by no blades at all. Most machines have blades; some do good work for small trades with one, when curved, but more generally two are used. Those with rods and those with worms and plungers like a man's arms, usually make the dough lighter and less compressed than many of those with blades.

A longer time and less pressure during kneading is not always a loss, because the dough afterwards recovers more quickly. The more the compression, the more yeast or heat must be given to the dough for it to recover itself quickly, and the absence of this started the popular opinion about machinery "killing" the dough. There are some machines of a circular character that are fixed in the ceiling, thus occupying no floor space whatever, and being completely closed, are of large capacity for the size, and, with extra yeast to make dough become ready quickly; they are emptied direct on to a table, thus entirely dispensing with any of the usual space-occupying troughs; this is an advantage quite impossible in hand bakeries. Some machines have a special arrangement for fanning in air during kneading.

Although a small dough can be well made by hand, it is so much easier, during a hard night's work, to stand and see the dough being made in machine that, with the increased concentration of trades and more work, many of the hand doughs are less well made, containing more scraps, and bladders, and liability to holes in bread than machine doughs. We remember, however, a baker getting more holes than before, but that was due to the fact that he made no allowance for the extra kneading given, either by extra yeast, or heat, or extra time, whereby there was insufficient recovery. A dough kneader does not of itself increase the yield of bread per sack, in fact frequently on the contrary, because, in the event of too much flour being carelessly let down, the latter will more easily be worked into, or absorbed by, the dough than would be the case in hand kneading. However, as a rule, the installation of machinery compels or suggests a more systematic procedure than hitherto reigned, then the weighed quantities of flour, and measured quantities and temperatures of water, lead to results more economical and uniform. As a matter of fact, where the same flour has been sent to two establishments, the yield in the machine one was less, because the foreman liked tight dough, which he would not have been so willing to make by hand, and the quantities of flour added were not definitely ascertained.

Section of Tin French.
(ACTUAL SIZE.)

Where flour is delivered in 140-lb. bags, there is not much difficulty in making a blend of known weight, although, of course, a far more satisfactory arrangement in large trades is to have an automatic weigher immediately above the kneader. There are some on the market that weigh a bushel at a time, and others that more conveniently hold and slowly discharge sufficient for the whole batch. The consistency of dough by its means, and also a measuring tank, can be obtained always exactly as required, and without any watching during kneading, the saving of material and the uniformity of mixing, and, therefore, subsequent regular speed of proof, are obvious.

It is not necessary in England to have separate machines for sponge stirring, although in Scotland and Ireland they are found of great advantage. They usually consist of a shaft with blades, that is let down vertically into the ordinary sponge or ferment tub. Like a kneader, they do the work better in half the time, doing the work well to the bottom of the tub, which is not always well done by the arm. These tubs, that sometimes take four men to lift, are also obviously better raised and emptied into the kneader by machinery. Some people in England, when using a dough kneader, still have sponges, which are unnecessary and a nuisance, and, moreover, still continue to break them, which is still more unnecessary, before adding to machine kneader. The fact that a sponge can be thoroughly incorporated in a dough, without pieces giving holes, and without previous breaking, shows the superior mixing powers of a machine. In the same way, when lard is added, it need not be melted or rubbed into the flour, but merely thrown into the machine.

The average baker, having first decided on an engine or motor and a kneader, will probably find his next best investment in a tank, fitted with hot and cold water, and a thermometer for the purpose of getting the right amount of water at the right heat for adding to his flour, instead of the greater labour and uncertainty of pails and hand dipping. If, however, he had a mixed trade, he might prefer a whisk or sponge machine, whereby he would save labour, and certainly get better sponge goods and cakes, and more yield, in spite of some opinions of better goods by hand when properly done. The construction and quality of these tanks, like other appliances, varies. Even when, as in the best tanks, the hot water runs in at the bottom and the cold at the top, the mixture is not always perfect, and is sometimes drawn off before accurately gauged in temperature by the thermometer. It is best to let the hot and cold run in at once, regulating the flow as the thermometer alters. Some have a movable perforated plate inside for mixing. It would be as well to test occasionally by inserting another thermometer in the top, and a little practice will ensure accuracy. The temperature of the water necessary to add to the flour in order to get a dough of a certain temperature, will have to be greater with a machine than without, especially for the first dough of the day in cold weather. Other variations will be seen by consulting the list of tabulated methods.

The next machine that an average baker could well do with, if not running himself short of cash, and injuring credit with his millers, is a flour sifter immediately above his kneader. Not only do these reject a surprisingly large amount of refuse, as can be seen at the tail of such machines at any time, but they enable the sacks to be more complетly emptied and shaken without harm, which is often a larger item than it may appear. They also enliven the flour, enabling it to absorb its full quantity of water, and to more readily make an even dough. Flour will always be found to take more space after sifting than before. Those that have brushes revolving on the sieve for rubbing the flour through, do the work in less than half the time of the vibrating sieves, where the flour gets through merely by shaking. The brush pulverises any lumps, which may sometimes be an advantage, but if the lumps are discoloured by damp, or other undesirable matters are present, as occasionally, then, of course, the forcing through is a disadvantage. A revolving reel covered with wire or silk, as in flour mills, is very efficient in some cases.

Having a sifter, one frequently next desires a blender. When wheats are mixed and allowed to stand together for a number of days, it is well

A SELECTION OF SHAPES.

known that up to a certain point they considerably improve one another each day, and yield better results. There are certainly advantages in blending flour beforehand, say, once or twice a week, and storing in hoppers, and it is sometimes worth doing even when again weighed off in sacks. It at least assures exact quantities of the various flours each day, and eliminates another source of irregularity, and can be made to effect economies with less risk. Some blenders are merely hoppers, fitted with slides at the bottom, and sometimes with rollers, for regulating the flour into a worm or screw conveyor. These work satisfactorily with dry hard flours, but are apt to clog or run less freely with softer flours. The safest plan is to shoot all the grades into a blending machine, to be mixed together, as in a kneader. The blender and sifter are sometimes combined in the same machine, with certain advantages. The flour should certainly be sifted just before doughing, if the blending has been done some days ; and there are certain advantages occasionally in sifting before blending, so if one is very particular, sifting could be done by a reel or vibrating sieve before blending, and by a brush sifter before doughing.

There is another machine that might be adopted more than it is by the average baker, namely, a brake. At one time a good deal of loaf bread was braked in this part of the country, as it now is in others ; the brake consisted of a long wooden pole fastened on a pivot to the wall, and being placed on top of the dough was not very comfortably "ridden" by the men. It made beautifully smooth and regular texture, but the work was hard. The old one has died out in these parts, and the new one has not been adopted. Most dough would be improved by more labour than it usually gets, except at exhibition time, and such a brake, provided, of course, recovery was given, would oftentimes supply the missing link, giving the smooth and regular texture, squeezing out the gas bladders which afterwards grow into holes. If the bladders and holes, or envelopes of holes, can be seen when cutting a moulded loaf through before baking, it is quite certain they will be present, and usually in an expanded degree in the loaf after baking. In some towns of Scotland and Ireland brakes are much used for the French and square or batch bread, the loaves being half moulded and passed through the brake, whereby, in addition to the other points already named, there is a greater uniformity of firmness, so that all loaves prove alike, which they will not do with the different handling of different moulders. Uniformity as well as finish, and rendering moulding easier. Where the bakery plant is most complete, the brake is less required, because in the same way that a well-made machine dough, when quickly fermented, and not allowed to get dry, cold, or skinny on the surface, does not require cutting back, so is a dough that has passed through a loaf divider considerably compressed, and already braked as to need less handing up or manipulation, being, in fact, almost half moulded. Also the machine moulders, which have just recently made their appearance, give the desired uniformity.

The machine loaf dividers have evolved from the experimental stage, and some of the types are now a complete commercial success. No large factory can afford to be without them, and in the smaller ones it is chiefly a question of ways and means. The best machines are a considerable saving in time, or the number of men required for the same work; but, perhaps, the regularity, and therefore the saving in the weight, is the chief recommendation. Although hand scalers get very expert, there are often considerable variations, to say nothing of occasional straying lumps, and we oftentimes receive loaves overweight from men that on occasions may be hauled up for the contrary. Correctly speaking there is no legal weight in England; the law merely requires bread to be sold by weight. Custom, however, has established loaves of 2 and 4 lbs., and when found less than this they are taken as evidence of not having been weighed. Uniformity in weight, or knowing what one is doing, is certainly of importance to the seller, whether for wholesale, family, or counter trades. Large factories have for some long time been accustomed to a machine that was fed by dough previously weighed in bulk, and then cut by its knives into forty-eight half-quartern pieces requiring to be carried away in a tray. These large ones for power were similar in principle to the small bread or scone dividers, worked by hand, to be seen in very many small bakehouses. This older type of loaf dividers is now becoming superseded by those machines that are fed with unweighed dough at the top, and discharge the weighed pieces on the moulding boards automatically.

We know of some of these loaf-dividing machines—even the most expensive ones—in use in bakeries doing weekly less than 100 sacks with most satisfactory and economical results. Other figures could be produced, but it will suffice here to repeat a printed statement of a Glasgow baker, to the effect that three men did 160 dozen half-quarterns (1920 loaves, 960 quarterns or 10 sacks) per hour, which formerly took nine men. Times for other batches and conditions will be found amongst the tabulated methods at the end of this book.

This completes the chief machines that are normally required in a bread bakery. Although operatives at one time opposed machinery, as others did railways, enough has been said to show that machinery means gradually raising bread-making from a domestic calling, which it still largely is, to a more important and more concentrated industry. More system will be created, with the result of more work in fewer hours, better health, and better wages, especially for the leading men, and also more independence and better results for the employer. One has only to look around—take the biscuit trade for example—to see the real and inner meaning of these remarks, and to realise the evolutions born of time.

When arranging the position of machines, it should be remembered that a long drive, that is, a long belt, will better grip a pulley—the larger the better—and prevent slipping, than a short, and also that the belt can thus be slacker and last longer. Resin, especially in lumps, and also even when finely powdered, is destructive to belts, although an easy means of getting the machine driven, when not troubling to preferably shorten the belt. The latter frequently stretches, particularly when new. It is best to apply the resin only after dissolving in oil, and then allow belt to dry before using, because when wet the oil might increase the slipping rather than otherwise. Where bearings are oiled by needle lubricators (inverted bottles with rod projecting), it is as well to see occasionally if the oil is flowing freely, even if the bottle may yet be half full. The grease lubricators are cheaper, more certain, cleaner, and usually used in mills and on heavy machines, but require attention, or turning, more frequently than the others, which they may not get in places where there is only a little machinery, and not well supervised.

OVENS AND FIRING

A BAKER cannot be a baker without an oven. There are a large number of different types of ovens of very different efficiency and characteristics, and even a larger number of opinions concerning them. We will refer first to the steam-pipe drawplate oven, which is suitable for all but the smallest trades. Some years ago these ovens were not nearly so perfect as they are now, the pipes were fewer, the heating less satisfactory, the withdrawn plate supported on fixed rails, which were in the way, and occupied space in the bakehouse, and prejudice prevented many men from even looking at them. It might be mentioned that being so well known to, and so closely connected with, the various engineers and oven builders, we are particularly anxious to deal with principles only and not willingly in this place favour or otherwise any particular firm. These drawplates, whereby the entire surface of the oven on which bread is baked is drawn out into the bakehouse, are usually made entirely of iron, but in some cases they have their baking surface covered with tiles. These tiles, on which also the name of the baker can be embossed so as to mark his loaves, are more cumbersome, but more closely resemble in their effect the thicker and more porous bottom crust of the older fashioned ovens. These plates can be withdrawn, then loaded with the batch and set into oven easily in less than two minutes, and an even less time is necessary to empty it or "draw" the batch. Batches, with the exception perhaps of the first, can come out regularly throughout the whole day easily at every hour. We know where six drawplates, of rather larger size than usual, are doing 600 sacks per week, or 100 sacks per oven, but a more general and a fair allowance would be about fifty sacks per oven per week, varying, however, considerably with other conditions. Not only is there an advantage in time and baking capacity, but every loaf can be set exactly in its place, and also by unskilled labour in greater quantity instead of one skilled man at the oven's mouth, or at most two. (There are, in some few cases, two doors to a peel oven, enabling two men to set simultaneously, meeting one another's loaves in the centre of the oven.) All loaves going in and coming out together, they get the same amount of baking, becoming uniform in colour and weight.

Some of these steam-pipe drawplate ovens are costly, which hampers their adoption by some; space, however, cost, and fuel can be lessened per oven when two are built as deckers; but, although the plates can be got very closely to one another so as to be worked from the floor level, their convenience and capacity is somewhat lessened for quick trades. Drawplates can be, and are, fitted to hot air and other special ovens. Some bakers complain of bakeries being made hot by drawplates, but it must be remembered that the plate is out for only a total of three or four minutes for setting and drawing instead of the door of peel ovens being open fully a total of thirty minutes; and the furnace is almost always outside at the back instead of side flue and Scotch ovens and others being fired at the front, some of them under the oven door and very hot to the legs. Although drawplates are eminently suitable for crusty bread, we have seen good batches of crumby, and even Scotch squares, baked uniformly and in less time than in other ovens, the loaves being kept square by a box arrangement.

The principle of heating by steam pipes is the same in all cases. Each pipe is about 12 feet long, running only from the furnace to the other end of oven, having no join or curve, and has about a ½-inch bore, which is partly filled with 2 or 3 pints of water. The pipes being sealed and tested to a high pressure and slanted towards furnace, the water is boiled at a sufficiently high temperature for baking, and the success and price of the oven depends largely on the differences in the quality of these pipes and the number of them used. In some cases there will be one row at top and two rows at the bottom as against in others one and one respectively. Some of the more substantial and brick built ovens on the steam-pipe and peel system are expensive, but of good value, being marvellously durable; others which are becoming very popular, are built of a more portable character, having iron plates lined with silicate cotton and merely the furnaces of brick, and fired at side. Prices vary according to prices of materials, and also according to the work and details of building. These peel ovens also often have iron soles which give out heat more quickly than tiles, and therefore, when mismanaged, but not otherwise, occasionally burn the bottoms. Cottages baked in shallow metal pans are, however, often preferred to those baked on the oven bottom. Externally heated hot air ovens—flues pass under and over them—are usually low crowned and built in two decks, sometimes three, and therefore very suitable for cakes, the top one being cool enough for rich or wedding, or other similar goods.

Vienna ovens should have slanting soles for holding steam, and for easily drawing rolls. Other ovens are of different construction to those which are sufficiently described above to any baker, who has now greater facilities of seeing them than formerly. Some of these might be classed as chamber ovens. One type that is now coming more prominently before the trade consists, in principle, of two or three iron boxes placed in a chamber, which is heated by hot air entering at the top from the furnace, then spreading round the baking compartments, and finally, when cooler and heavier, by having circulated round the boxes or ovens, is drawn off, contrary to any other type, at the bottom, after being therefore economically used to the utmost. In these the heat can be quickly regulated. Other ovens that are used in America, but only seen by the writer in one bakery in this country, consist of a huge chamber, round which the products of combustion circulate in flues, instead of directly entering, as in the case just described, and within it a revolving reel or drum with trays, being constructed, filled and emptied on practically the same principle as the big pleasure wheel at the Earls Court Exhibition, and at Blackpool, etc. The continuous character, and the perfectly regular baking of all the loaves, and the suitability for tin bread, is sufficiently obvious.

Another American oven is known as the "crustless," specially designed for sandwich bread to save waste. Although this oven has come specially under the writer's notice, in connection with other inventions of the same firm, he does not know of any working in this country. The dough is prepared in the usual manner, and, not being baked by direct exposure to the heat rays, is steam-heated in a completely closed iron tank on an entirely different system to the so-called steam, or steam pipe, ovens hitherto mentioned. The steam is derived from the exhaust steam of the plant. Another uncommon type, which makes delicious cake like bread, and which also we believe originally came from America, is the vacuum oven, only one installation of which we have seen in this country. The air is exhausted from the oven, whereby, the pressure being removed, water boils at a low temperature, and the bread is raised entirely, without any fermentation, by the absence of pressure, and by the steam produced from the water within it. There are electrically heated ovens, chiefly used on a small scale for flour-testing purposes; also reel or rotary ovens for biscuit-baking, where trays or tins of goods are put in unbaked at one end and delivered baked at the other. The reel or drum oven, as described above, is loaded and unloaded at the same spot.

This completes practically all the chief types of so-called externally heated ovens, that is, where the products of combustion do not come in contact with the interior. In spite of their many advantages of continuous baking, the firing being kept going while the batch is baking and even made up ready for next batch, the absence of fumes and dirt in contact with goods, the absence of soot hangers, the absence of scuffling or cleaning out with damp cloths, and injuring—especially when the scuffle is very wet—the oven soles, there are still many bakers who prefer, and still erect, the internally heated ones, such as the so-called "furnace" or side flue oven, the Scotch oven, the wagon or chaffer, and the wood oven.

The wagon is peculiar to Lancashire, and has hitherto been very popular, with, however, now signs of waning in the Manchester district. It consists of a movable furnace or basket fired with coal and wood, deriving its draught through a long iron pipe of about 4 inches diameter. This pipe has its opening in the centre of the oven door, and is shortened when the wagon is shifted, for purposes of regular heating, nearer to the opening. Wood ovens that are fired by burning faggots on the sole, are liked by some because of flavour, although there have recently been cases of poisoning by burning painted wood, and also because of so-called economy; but we know cases of four oven soles being required in three years, each sole consisting of sixty tiles, costing, by the time all was paid for laying, etc., about a shilling each.

The Scotch oven is a difficult one to root out of Scotch favour. It is fired by coke, and is certainly economical and durable. The furnace is usually in the right hand corner, and is fired entirely, and relieved of its clinkers entirely, through the oven door. In some recent cases there is a special arrangement, whereby the furnace bars are not fixed permanently as usual, and can be raised so that clinkers can be extracted through the ash pit door instead of oven. The crown is high, carefully shaped for purposes of draught, and the soles are frequently made of stones or tiles 8 inches thick. There is one flue placed, as opposed to the English furnace or "side flue" oven, in the front, about a foot from the crown, on the left side of oven door when the furnace is on the right. The Scotchman says there is nothing to equal it for close set bread.

The side flue, like the Scotch, usually has its furnace on the right side, but is fired through a separate furnace door, having its one flue in the diagonal or back corner, controlled by a damper or register at the front. It is fired usually with coal, but occasionally more economically with coke, when built with a differently shaped and larger furnace, or, as it can be, easily and cheaply converted. The coke furnace requires to be wider, bigger, and higher, say, about 3 feet high and nearly half as broad, and fire-bars as long as the height, and then a shaft about ten times the height of furnace.

This completes all the leading types of ovens, with the exception of those for portable and field use. Gas ovens, with no flames inside, for caterers' or household use, can be obtained from an internal size of 2 × 2 × 12 feet, up to 4 × 2½ × 15 feet.

In conclusion, one need merely say the selection of ovens must be according to cash at command, size, character, and scope of trade, and space or ownership of premises. Some builders give better value than others, but some low priced ovens, where the top one soon sags into the bottom, or otherwise falls to pieces, as occasionally seen, are, of course, dear at any price, and the greatest personal caution, or the obtaining of an independent outside opinion from anyone whose business it is to make a special study of the subject, will always be fully repaid. Two small ovens are always better than one large. The size of an oven is often styled according to the amount of crumby set or plain bread it will take, which, of course, is misleading when thinking of long loaves, tins, or crusties.

The proper firing of ovens is of the utmost importance. First of all, there is the draught, which owes its origin and degree to the differences in weight between the air in the chimney and the air outside. Therefore, as hot air is lighter than cold, the hotter the air in the chimney or shaft, the greater the draught. Further, as a long chimney contains, all other things equal, more hot air than a short, the longer the chimney, the greater the draught likewise. Therefore, it follows that a furnace, when once started, draws better in cold weather, because the outside air, being colder and heavier, is in greater contrast to the inside air. Likewise, the admission to the chimney of more cold air than necessary decreases draught. Similar, in principle, to this is when stopping the excess, by holding a newspaper, or blower, in front of a domestic fire, or by stopping up one flue, when, in the same chimney, two meet. As seen in the article on ventilation, a shaft over a gas-burner draws off more air when the burner is lighted; also, the shaft draws better when smooth, and with no rugged places, and with no big places, or with no narrow parts, and should not have a narrow pot on top, or more bends, than absolutely necessary. Although an excess of cold air decreases draught in a chimney by equalising weight, there must, of course, be sufficient admitted to the furnace, as otherwise the capillary attraction, caused by the velocity of the wind passing over the top of the chimney, which always exists in proportion to the velocity of the wind, even with no fire, could not be permitted. Thus, the importance of removing clinkers and keeping fire-bars clear. These can often be detected, by looking under the bars when the fire is burning, by the dark places produced.

A steam jet, or tray of steaming water, underneath the fire, increases draught, and, when properly regulated, indirectly increases heat, by brightness and chemical changes, but not because of the popular idea of burning hydrogen, which is opposed to the laws of science. As heat depends on the completeness of the combustion rather than on the amount of fuel, it is no economy—in fact, on the contrary,—to put on rubbish, as often done, which only impedes the combustion of the other fuel. If the object is merely to get rid of the rubbish, and to check combustion when banking up fires overnight to save time in morning, in the same way that wet coke and cinders are added, the circumstances are rather modified, as that perhaps is preferable to the worse and ineconomical evil, in the case of most continuous ovens, of letting out the fire entirely. When properly banked up overnight with wet coke, the damper should be out only a little way, and then when fully drawn in morning, a bright fire with a little additional coke is soon produced. The coke, in the case of pipe ovens, should be broken small, and very evenly spread, added at frequent intervals in small doses, so that the fires remain small and bright. Coke being nearly pure carbon—the coal minus the gas and water—to the extent of about 95 per cent., wants about ten times its weight of air to burn properly, which it cannot do with the same effect if put on in large quantities at once, making the fire dull, and unless spread over the pipes evenly, which are all separate from one another, the oven cannot be equally heated.

Too much fuel, and also impeded draught, will sometimes make ovens "blow back." Also, small fires require less draught for good combustion, and the bigger draught often carries off much of the heat.

On the other hand, too little draught, which makes soot and smoke with coal, makes with coke a poisonous gas, known as carbon monoxide, to which fact even the eminent M. Zola recently owed his death. This gas is unfortunately almost odourless, therefore giving no warning like ordinary gas, and 1 per cent. of it in air is sufficient to kill, while one-third of that quantity is dangerous. Even a bunsen burner, however, evolves some. This gas is very stupefying, burns with a blue flame on the furnace, when it does not escape to do its mischief, and combustion of the coke being thus imperfect, much heat is lost. In fact, it is owing to imperfect handling that these pipe ovens often take more coke than necessary, and in cases are less in favour than they deserve. Coke, by-the-by, should be measured each day, and be well selected, hard, porous, and not dusty. To render management easier, some two or three firms are now arranging to fire these ovens by gas, not the ordinary kind as referred to, and expensive to use in ordinary gas ovens, but the non-luminous gas as previously mentioned as being made on the Dowson principle in connection with gas engines. This can be ready each day before commencing to bake, and by playing on the pipes overcomes unequal stoking, or badly regulated draught, saves room, saves clinkers, therefore increases efficiency, with less wear and tear on pipes, and can be regulated to a nicety from the bakery and front of the oven by the foreman—advantages that will probably be found will more than compensate, in large places, the cost and working of the gas-making plant. This would overcome the objection in some cases of using the ends of the bottom pipes as furnace bars, instead of having separate bars, although, of course, these ends must always have some water left and unconverted to steam, or would be burnt through much sooner than some we have seen in Hampshire that have been erected over thirty years.

Referring now again to the internally heated or side flue ovens, the coal should likewise be put on in small instalments frequently, and then at the front, the hot or burning coal being pushed back. The smoke from the newly added coal has then less opportunity of showing itself at the top of the shaft or wasting, being more consumed by passing over the hotter and brighter burning coal, and also for a little while the furnace door should be left slightly open. Small and dusty coal is more likely to clinker on the furnace bars. Although side flue ovens are built of brick (the more material the more the heat is absorbed, and then afterwards given out gradually) they, by their internal and non-continuous firing, quickly rise and fall in heat. They require knowledge and judgment in the time allowed for them to equalise or "lie down," and for setting the different sorts of bread, because, although required to be fairly evenly heated so as not to burn or boil, the back wants to be cooler than the front, because the loaves there go in first and come out last, and the other cool place is close to the oven door where the loaves go in last and in the ordinary way, unless shifted during drawing, come out first. The lack of uniformity here is an advantage in some cases and a disadvantage in others. Brick radiates slower than iron, making thicker and more porous crusts, and stone makes harder crusts than porous tiles; and all such masonry work, when ovens are new, requires heating and drying very gradually, and for a longer period than those ovens built more largely with iron, if cracking is to be prevented.

A list of the different heating values of fuel has been published by us elsewhere, and here it will be merely necessary in connection with draught to mention that 1 lb. of coal requires for combustion 300 cubic feet of air, coke 270, wood 130, and coal-gas 340, and that if the air were supplied to the furnace hot, as, for instance, by passing where heat was going to waste, the fuel would be better consumed. In writing to a correspondent the other day concerning his fuel bill, we said he had nothing much to complain about in burning "close on," as he said, a ton of coal per week for four ovens of ordinary furnace type, but that he did not need four ovens for forty-five to fifty sacks. Nothing was said as to baking other goods in addition to bread, and bread alone should be done in two ovens, which would not, of course, take as much fuel as four. We mentioned having ourselves done thirty-five sacks in one side flue oven at a push, and it is easier work to do sixty in two ovens, of which we know instances. Instances of drawplate work are given above. We remember, some few years ago, listening to a paper when the reader said his fuel (coke) cost him 1½d. for baking 6 bushels of bread—one sack.

Taking two instances immediately under our present acquaintance, we find one business baking twenty sacks per week in fifteen batches, and about £15 in confectionery goods with one oven, and 5 cwt. of coal (costing £1 per ton), namely, 5s. per week for the twenty sacks, or 3d. per sack (this was also the exact figure and condition in a larger trade), when not reckoning the smalls, which practically cost nothing, as they are baked between the batches, and after the bread is out, using the heat that would almost as readily be lost before the next day's baking. Another instance is a trade of thirty-six sacks per week, and smalls in two ovens at a consumption of 3 tons a month, which works out at about 5d. per sack, at the present usual price of £1 per ton. For the ordinary furnace coal oven, we used to reckon ½ cwt. for first batch, and ¼ cwt. for second. So much, however, depends on the oven, the construction of furnace, the kind of fuel, the size of batches, and the number of sacks baked, that it is best to answer by instances, as other noted personages did by parables. Other actual cases are 300 sacks per week, at an average of 3d. per sack; another, 200 sacks at an average of 4½d.; another, 300 at 5d.; another estimate is 2d. per sack for 300 sacks weekly, and 4d. for smaller quantities. Others work out at 4d. to 6d. per sack, and some small ovens, two working all day, take per day 1 cwt. of coke. Some prefer anthracite, which is like coke, burning almost smokeless, giving good heat, but in some places is cheaper than coke, requires more draught, and clinkers less. Wood takes less draught, and gives less heat.

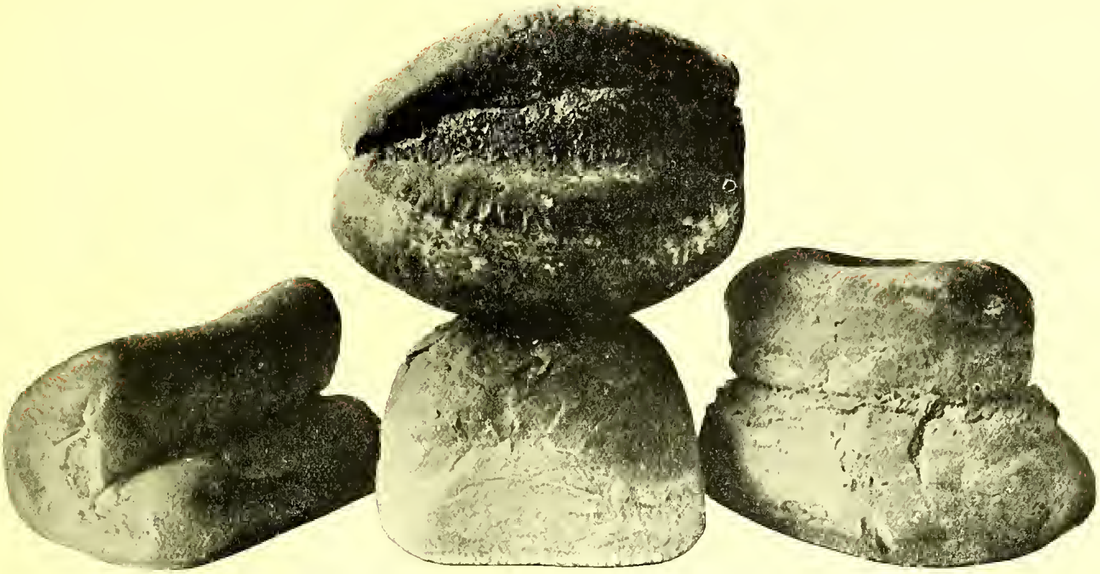
TROUGHS

ACCORDING to standard dictionaries, a trough is a long, hollow vessel for containing food or water, etc., and is correctly pronounced "trof" instead of "tro," but one never hears anyone call a baker's trough a "trof." The care of troughs and such like utensils is often very much neglected in many districts, but in Scotland this detail, like many others that account for the high average of skill there, receives very much more attention. Because of the effect on fermentation, cleanliness of utensils is of more importance in long and slow processes than in short and quick, where, in the latter case, larger quantities of yeast are added from other sources instead of having to be grown in the bakery. When at a bakers' exhibition at Mayence in Germany, exactly ten years ago, and also on many other visits to the continent, the author particularly noticed the large amount of iron and enamelled troughs exhibited, which, although perhaps not common in continental bakeries, must have considerably more demand than in this country, or they would not be on sale in such quantities. Many were fitted with a lining or hollow jacket for the purpose of adding hot water in winter or ice in summer, so as to keep the doughs at a more even temperature all the year round. The bottoms were cylindrical, or rounded at the junction with the sides, so that there were no corners to scrape out, and, in fact, while the enamel remained in good condition, cleaning and keeping sweet was obviously reduced to a minimum. Although they would not wear away like wood or require relining with all the risk of a putrefying mass accumulating behind, the enamel would chip occasionally and act in the same way as the other enamelled utensils more usually used here.

These enamelled troughs have much to recommend them from a public or inspection standpoint, giving a much better appearance and being more inviting than even a clean wooden one. They were, of course, on wheels such as sanitary authorities are now more often insisting upon, so as to give dust and refuse more chance of being removed from under them. Although feeling colder to the hand than wood, they would be of exactly the same temperature. Everything in the bakehouse, no matter of what material it may be made, is of the same temperature as the surrounding air unless, of course, some artificial heat be applied to otherwise affect. The air equalises all in the same way as everything, whether wood or iron, when put into a bucket of water will be of same temperature. Although it is necessary to mention the above in order to answer many curious ideas received in letters on this subject, iron troughs, and—the same thing in this respect—large kneading machines, certainly have an effect on doughs made in them, according to the following conditions.

An iron trough as compared with a wooden one does not chill the dough, as sometimes said, in the same way as the first plunge into a cold bath chills a man ; but because iron is a better conductor than wood it allows the heat of the dough to escape through it sooner, in the same way as taking off one's coat does not immediately strike cold but allows the heat of the body to exude sooner. The body will get cold, or have the sensation of cold, when a coat is removed, strictly in accordance with the heat of it as generated by vigorous action, in accordance with the difference in temperature between it and the surrounding air, and in accordance with the time, by the removal of the coat, that it is exposed to the difference. This, without further words, will be seen to apply in all points to a dough in a trough. A hot dough will more quickly lose its heat, but a cold one will not be made colder, will not be chilled, in fact, as sometimes might be the case, the iron trough would on the contrary allow the temperature of the dough to rise sooner than a wooden trough, by being in a bakehouse warmer than that required for the dough when finished making.

By reason of the above it is one thing to make a dough in an iron trough or machine and another to let it lie there afterwards to prove. We know, however, of a fairly large business where there is not a single trough in the bakery, all doughs being made by a very quick process and kept in the machines, of which there are several, till ready for scaling. The larger the trough



A SELECTION OF SHAPES.

PRIZE IRISH BATCH, OR TURNOVER, LOAF (HALF-SIZE).

or machine, or the more material about it, the greater will be the loss of heat, there being more to absorb the heat, and we have frequently found that a certain well-known massive machine required water 10 degs. hotter in order to make a dough of same temperature as that made in a smaller wooden trough, or 10 degs. hotter for the first dough than required for a second, which followed quickly and was of the same temperature when made; this would more particularly be the case when the water was put in first and some few minutes allowed to elapse while the engine was being started and the flour let down from the sifter above.

In the matter of keeping the troughs in good condition, it will be found desirable to lard them once or twice a week according to the amount they are used. The greasing of a tin, or an iron kneader, is sufficiently general for its effect to be well known, but the above applies to wooden troughs which in the great majority of cases never get anything more than a scrape. The melted lard, butter or oil should be put on with a rag or brush only after the trough has been thoroughly scraped; it is no substitute for scraping in the first place, but it will save it afterwards, as the dough will come out cleaner, that is, will stick less. Another little dodge not universally adopted and worth the doing is to sprinkle the trough with salt at the last turn when making the dough, this keeps the trough moist and thus renders scraping easier, whereas cones dry and stick on. There is nothing like injecting into old troughs a jet of steam once or twice a week to bring out any accumulations of scraps and germs that always, especially with troughs that have been worn and lined with slate or another piece of wood, get just where it is the most difficult to scrape. Steam has softened and brought out evil-smelling matters that were never thought to have been there. A wash once a week with warm water will also be worth the doing, and lids should be left up to sweeten troughs when the day's work is done, especially on Saturdays, when, as a matter of fact, in small businesses they are more often full of flour to save shooting on Sunday, when a sponge or dough is made over night. Lime is as well to use occasionally. One of the most handy antiseptics is a solution of bisulphite of lime, a two-gallon jar of which can be obtained cheaply from any chemist, and the troughs should be well saturated occasionally with this at the close of work, the sulphurous fumes being in that case kept in as much as possible.

VENTILATION

THE subject of ventilation, which was last discussed by the author in a special and long article just fourteen years ago, has recently been forced on the trade by the New Factory Act, and is not pleasing to the pocket; but in order to show that this is a far more important subject than many who feel the pinch like to believe, it would be well, in passing, just to quote the words of such an eminent authority as Dr James Johnston, who, in speaking of impure air, says "that ague and fever—two of the most prominent features of the malarious influence—are as a drop of water in the ocean when compared with the other less obtrusive but more dangerous maladies that silently disorganise the vital structure of the human fabric under the influence of this deleterious and invisible poison." The impurities likely to be found in the air are legion; and when recently studying a sample of air as seen through the microscope, the author was much interested in some of the solid particles. But, notwithstanding the deleterious effect that an excess of flour-dust would have on the lungs, let us pass over the visible substances, and consider the so-called "invisible poison," which consists of vapours, gases, and, more especially, when in excess, carbonic acid gas or carbon dioxide.

Many of these impure gases, exhaled from the body or rising from drains, cannot be detected by smell nor taste, and are inhaled without any knowledge on the part of those who breathe them; others are smelt at first, but in a short time, if the impurity still remains, the nerves lose their delicacy. Therefore in many cases, to those surrounded by the poison, there is an absence of warning, which warning remains to be given only by any chance person entering the bakehouse whose nerves have not been acclimatized. The amount of carbonic acid gas in so-called pure air is about four volumes in every 10,000, but the air exhaled by a man, even when not undergoing any exertion, contains just a hundred times more of this noxious gas; so it can easily be seen how soon pure air is rendered impure. Besides that exhaled from the lungs, there are also exhalations from the skin, eliminations of organic matter, formations of watery vapour, and escape of gases from the dough.

If, therefore, we wish to keep the air of such a composition as to be consistent with health, we must have arrangements for supplying each man in the bakehouse with at least 3000 cubic feet of fresh air per hour. If we employ ordinary gas lights, these again have to be taken into our air-supply account. There is a great difference between lights from which the products of combustion are drawn off, and lights from which the products of combustion are allowed to remain in the bakehouse. For every cubic foot of gas consumed, about 2000 cubic feet of air must be admitted to properly dilute the products; so a small burner, burning, say, only 3 feet per hour, requires 6000 cubic feet, which makes it equal to two persons; and this is only a very moderate estimate, some authorities contending an ordinary burner destroys the air as much as six or nine persons. Let us now suppose our bakehouse is 20 feet long, 15 feet broad, and 10 feet high, and that we require two men to work in it all night. Since the bakehouse (20 × 15 × 10) contains 3000 cubic feet of air, and two men, to which we must add one gas burner, require collectively 12,000 cubic feet, we see that the atmosphere must be entirely renewed four times in every hour. How we can do this without the sensation of draught, and without, in cold weather, checking our fermentation, or how we can legitimately decrease the amount of air required, is the next point to be considered.

Thorough ventilation consists chiefly of two operations. Firstly, in carrying off regularly and constantly the air which has become vitiated and used, etc. And, secondly, in introducing fresh to take its place without the sensation of draught. Perfect ventilation is not brought about by occasionally opening a window or a door, but there must be a system in which the inlets are balanced by the outlets. The next axiom is that fresh air must be introduced at a level low enough to mingle with the coolest and best air already in the room or bakehouse, and yield its oxygen to the occupants before it is contaminated by the hotter gases floating near the ceiling. All irregular entrances for air, either by badly fitting windows or through open doors, should be stopped. The air must be introduced in such a manner and at such a temperature as not to be felt. Thin windows are a hindrance to perfect ventilation, because their cold surfaces cool the hot and used gases, and thus cause them to descend to be breathed again by the occupants. On account of these cooling surfaces there always seems to be a draught near a large window by reason of the current of cooled air falling, although there may not be a single crevice in it; and even if we fail to personally discover this draught, a sponge set away in a trough underneath the window for some eight hours would be more sensitive. In summer, means should be provided for cooling the incoming air, and in winter for warming it. The most efficient means for carrying off the impure air is an upright shaft leading from the ceiling direct into the outer air. The operation is more effective and quicker if the shaft be warmed; the longer, the straighter, the larger, and warmer the shaft, the quicker the exhaust.

Having enumerated the chief principles, to which, however, details could with advantage be added, let us now see how to apply them practically. Draught that is felt is due to one of two causes, either that the incoming air is improperly diffused, or that it is of a widely different temperature to the air already in the bakehouse. In order to concur with the axiom concerning the height at which the fresh air is to be introduced, we must have dados, or trunks or pipes, leading from the outer air into the bakehouse, at a height of about 3 feet from the ground. The tops of these dados are covered with perforated zinc, so as to diffuse the current of the incoming air, and this precaution against draught—taking into consideration that storing air in the dado reduces gusts—is found sufficient, except at extremes of seasons. These dados could be furnished with water-pipes which, in the extreme winter could be supplied with hot water, and with trays, which in extreme summer could be filled with ice, so as to temper the air as required to suit either season. These precautions for regulating temperature may seem excessive to some, but the author has visited several large bakeries that find similar arrangements serviceable, particularly in the store and sponging rooms. The amount of inlet space allowed to a single person should be about 24 square inches, although four times this amount of opening will be found to be too much for four persons, and 48 inches is large enough for any one inlet. The dados should therefore have valves, simple in construction, to admit of the inlet being regulated.

Now we come to the outlet, which should be in strict proportion to the inlet. Outlets should not be near the inlets, but, on the contrary, should be near the roof of the bakehouse. Particularly also in the case of bakeries, where the draught of the furnace is sometimes so strong as to draw air from all openings, whether designed as inlets or otherwise, all outlets should be fitted with valves. These, conveniently of mica, are for preventing any reversal of the organised system whereby cold air incorrectly coming in at the top and thus falling by its greater weight on the workers, causes the draught to be felt, and also condensing and cooling the impure vapours and gases that by their lightness had risen to the top, and would, when cooled by cold air coming in at the wrong place, again mingle with and pollute the fresh air instead of being carried away. The outlet shaft is more efficient when heated, and after taking in at the ceiling of the bakery should, if possible, be run up alongside the furnace shaft, whereby its efficiency would be automatically increased, when the furnace was going and making the shaft hot, just when otherwise, as explained, it might have difficulty in acting at all. Shafts or exhaust pipes can also be rendered highly efficient by being placed over each gas flame, tapering out and placed, like the usual so-called "smoke consumers," over lights. This arrangement would not only ventilate the bakehouse generally, but would obviously at once take off in a concentrated form the products of the gas flame that would otherwise mingle with the rest of the air and then require a corresponding greater ventilation to be efficiently extracted.

While speaking of the products of gas flames, it will be useful to refer to some exhaustive experiments recently published in the "Home Office Report on the Ventilation of Factories and Workshops." After giving the full details, the authors conclude with the significant words :—"The table shows clearly the great economy in gas consumption when mantles are used. Their much more general employment in factories and workshops is very desirable, with a view to avoiding excessive vitiation of the air, and at the same time obtaining a good and perfectly steady light. By the use of the incandescent electric light all the inconvenience due to air vitiation and heat from gas-jets can be avoided, though the extra expense as compared with incandescent gaslight is considerable."

Much has been said about the difficulty of ventilating underground bakehouses, but if the matter be thought out, in accordance with the principles mentioned above, it will not be a difficult thing for anyone who has studied the question to advise and arrange for efficient relief, and be able to bring about considerable improvement in various ways, according to the individual conditions. It is, however, curious that many people who might be expected to know better, but are handicapped by not having given attention to the peculiarities and necessities of the bakehouse, cause much money to be spent unnecessarily, and also without much benefit. Much bad ventilation is due to bad regulation of the currents irrespective of the size or position of the opening, and this is now recognised in connection with railway tunnels, where there is a big difference in ventilation between one tunnel to accommodate the up and down lines and separate tunnels for each direction. If the place is so small and awkward that these currents cannot be sufficiently supplied on the one hand by the dados or Tobin tubes, the air bricks in the walls, the Sherringham valve or slanting opening for directing the draught upwards, and, on the other hand, by the shafts over burners, or near or up the oven flues, or other regulated and valve-covered outlets, then a fan or propeller must be placed in the wall near the ceiling.

These fans are now more often worked by electric power, and can also be hydraulic or water worked. The way in which difficulties can be overcome could be illustrated by instances from mines, and also from the familiar bee hive. These dome-shaped buildings are without windows or openings anywhere except one small hole in the front at the bottom, yet are numerously inhabited by active workers, and known to be well ventilated. If one takes small pieces of paper attached to threads, hanging them in front of this hole in the hive, there will be noticed two distinct currents, one entering and the other leaving. According to naturalists, there are just inside this door two rows of bees continually vibrating their wings in their respective opposite directions so as to produce these currents of air to probably ventilate a place that would seem far more difficult than the worst of bakehouses.

In ascertaining the amount of organic matter or impurity in the air, the well-known ammonia process or other direct test is seldom employed, but the impurity is estimated according to the amount of carbonic acid gas or carbon dioxide found present, because the two usually bear a fixed ratio to one another. This is hardly fair in the case of bakeries because, as will be seen, the proportion naturally present in the air is so small that it can be appreciably increased by the gas, which is of exactly the same kind, from the fermentation of the dough. This carbon dioxide is not poisonous or injurious of itself, although not supporting life and suffocating anyone descending into a well filled with it, and allowance therefore should be made for this extra source ; but, on the other hand, through mismanagement of the oven furnaces, there is sometimes present a far more poisonous and stupefying gas known as carbon monoxide. The composition of air when pure is

Nitrogen	79.01
Oxygen	20.95
Carbon dioxide	00.04
	100.00

Although there are traces of other gases, such as the recently discovered argon, and also ammonia, and, in bakeries particularly, sulphurous acid gas, the above table clearly shows the relative importance of carbon dioxide, which is treated as an impurity when exceeding .06, that is, six parts in 10,000. There is more of it in the air at night, plants then exhale it, than day, and more in summer than in winter. In bakeries the amount will practically always be above the six parts per 10,000, but in a recent report of the Departmental Committee on various trades both the amount of this gas and the temperature came out very favourably to bakeries. In cloth factories the allowance is nine parts, but even in schools and lecture rooms various tests have shown fifteen and twenty parts.

By reason of the well-known action of this gas in making lime water turn milky, it is very easy to test for oneself the air of a bakehouse by taking a flask of a known capacity, filling with the air to be tested, and adding a definite quantity of this lime water. For calculation purposes, a convenient size of flask would be one holding 10 fluid ozs. of air together with half an ounce of clear lime water. A rag should be put into and completely fill the flask, and be removed in the place where it is required to test the air, the latter, of course, then rushing in. On adding the ½ oz. lime water and shaking for about five minutes, the milkiness will form, provided the amount of gas amounts to the point at which it declares the air to be impure, namely, 6 parts per 10,000, The amount of the impurity will be gauged by the rate at which the milkiness forms, and the intensity of it. It can easily be increased, and the variations noted by way of experience or curiosity by inserting a tube and blowing into it one's breath. However unwelcome it may be, and however impossible of universal attainment in the bakery trade, or however unnecessary compared to other trades, it is a fact, nevertheless, that the 250 and 500 cubic feet of air space per man recently proposed by the authorities is not, in cases where gas is required for lighting and where men are in active physical work, in any way unreasonable or excessive, according to the recognised laws of hygiene.

SECTION VI

METHODS OF FERMENTATION AND MANUFACTURE

"With caution judge of possibility,
Things *thought* unlikely, e'en impossible,
Experience often shows us to be true."

METHODS OF FERMENTATION AND MANUFACTURE

MANY hundreds of times throughout a very large correspondence and also by personal contact with a very large number of bakers, the writer has been asked what is the best method of bread-making. There is no universally best system, except the one that gives an ærated and digestible loaf suitable to one's requirements in the most simple, shortest, or most convenient manner in accordance with circumstances. Exactly the same formula of method will give different results with different people, and often loaves made from very different methods can be distinguished only with difficulty. The different tastes and localities, the differences in men, materials, appliances, conveniences, style and size of trade, must govern the details of any method that one might wish to adopt ; and recognising this point, it has been deemed advisable to append the accompanying tables of methods and also illustrations of loaves, which together constitute the leading feature of this book, and have been prepared at a very great cost of time and money, quite unprecedented in connection with the bakery trade.

The methods that are thus classified in counties or districts are only a very small proportion of those recently received from correspondents, and with the exception of some supplementary ones to make them completely representative, are given exactly as sent. Each one has been selected because of some special lesson that it teaches, either by the details given, or its relation to other methods, and the remarks made by us on the loaves that were produced. The methods given amount to no less than 360 different ways of making bread arranged under thirty-two headings, and in addition to others supplemented by ourselves, are selected from upwards of 1000 that have been sent by correspondents from all parts of the world when seeking professional advice concerning their bread, which has been discussed either in the press or else direct by post.

Tabulated matter is sometimes passed over as being more difficult to study than continuous letterpress, but in this case it must be remembered that the methods here given and the remarks on the loaves therefrom, the excellences and faults of them, are the essence of some years of close study of actual practical bread-making operations and results, and the concentrated information in a convenient form of far more writing than elsewhere contained in the present book. As such therefore the pages of methods, if closely studied, closely compared and thoroughly considered, will convey more information, answer more of the questions so often received, and give more new ideas than could possibly be done in many other ordinary pages. They should be studied before reading further here, because the following remarks, although necessarily full, are but supplementary to, and connected by, the information there contained. A very large proportion indeed of the senders of the loaves, far in excess of what might reasonably be expected, have subsequently been winners at the exhibitions; and any other information that may be desired in connection with this subject, or any other of an individual character, can be had on application.

By studying the tabulated methods it will have been seen that every district of the Kingdom is represented, and also every system of bread-making that is at all general. The collection is certainly unique. Good bread will be seen to have been produced from the widely divergent methods; in fact, at all times quality is as much, or more, dependent on the management and workmanship as the formula. Although good bread is still made from long and intricate processes, as seen by the Scotch list, it can also, as at exhibitions and in other instances given, be made from short and simple ones. The best all-round system will usually be found between the two extremes, because for commercial purposes quality must be judged and be largely subservient to convenience and economy. Tradition, or rule of thumb handed down from generation to generation by the accumulated experience of results without knowing reasons, must now be governed by science, which, correctly defined, is nothing else but the experience and perfected knowledge acquired by trained, intelligent, organised, and systematic observation.

Not everyone has the training to correctly understand all the phases of experimental results, or the pluck or opportunity to tamper in their daily trade with a system they already know. Many a man can do daily with excellent results what he has always done, but completely fails directly any condition is altered. To such men, who on that account do not believe anything can be right but what they themselves do, the accompanying tables should be of the utmost value. For years we have been advocating shorter and more simple systems than formerly in vogue, and have countless letters from those who have, as a result, discarded their prejudices, and who now make as good and better bread with less trouble and anxiety. Some of the most obstinate of our correspondents are now the most loyal and enthusiastic. There is no doubt that systems are much shorter than they were, that the former necessity for their length is no longer a necessity or advantageous, and that the next few years will see even a greater average shortness and simplicity of methods of bread-making throughout the world. Let us not forget that at one time ardent travellers thought they knew the entire world, and then Columbus discovered a continent that was bigger than their own, and is to-day of vast importance and prospects.

The most prominent amongst short systems is that known as the straight or off-hand dough method. It is, however, erroneous, as is often the case, to consider a straight dough as necessarily synonymous with a short process, because a straight dough can be a long one. A straight dough is a dough that has been made from the whole of the yeast, salt, water, and the whole of any other ingredients, at one operation, that is to say, a dough that has not been preceded by a ferment or sponge. It is incorrect, as is sometimes done, to speak of a ferment and then afterwards to speak of the dough, into which it has been put, as a straight dough, and also to speak of the time as "from start to finish," as is also sometimes done by correspondents, as being from the period of making dough. The preliminary start that the yeast gets for, say, a quarter of an hour in a bucket with a little sugar, or malt extract, just while other things are being got ready, cannot be called a ferment as ordinarily understood, and is to be recommended.

With such a preliminary start, a good average method for a sack of 280 lbs. flour would be three and a half to four hours in trough at 80 to 85 degs. F. when made, and $3\frac{1}{2}$ lbs. salt, 8 to 16 ozs. sugar, $1\frac{1}{4}$ to $1\frac{1}{2}$ lbs. yeast (distillers' compressed), the variations being given to allow for different seasons of year, different qualities of flours and yeast, and different kinds of bread. Variations will need to be made for batches following one another, according to the conditions of the trade and conveniences, etc., but the above will be found a good standard to which to keep as closely as possible for all-round average commercial results. In country trades, or where time is not of so much object, and flour is softer and yeast dearer, it would usually be better to have six hours in trough at 80 when finished making, and 1 lb. of yeast. Longer time can be given with success, although not so desirable; thus nine to ten hours could be given at 70 degs. when finished making, and 8 ozs. of yeast, and the intermediate times will usually be found to work out at about 2 to 3 degs. of heat in the mixed dough, or 2 to 3 ozs. of yeast for every hour.

The great advantage of knowing different methods and studying the details as given in the accompanying tables, is being able to arrange one's work to suit one's convenience. Many have grown accustomed to what they would consider great inconveniences if they had now to commence, and any change seems more troublesome than it otherwise would. Such a system as suggested above is undoubtedly a saving in time, labour, risk, frequent attention at inconvenient periods, trough room, flavour, and waste, etc., therefore any extra cost for yeast is abundantly compensated. Even greater quantities of yeast, as dealt with under that heading, are not wasted, as, when properly managed, a more vigorous fermentation will cause a loaf to stand up better when containing more water, and anything up to 2 lbs. of yeast per sack can be made to pay for itself, although in many places it does not.

Flour of only moderate strength will not stand an extreme in either direction, namely, either a very long process or a very short one, and is best suited by average time, as above. In the long method it gets changed too much, and in the excessively short one it gives no size, the extra heat required taking "the belly out of it." Heat is, of course, developed during fermentation by the chemical changes, and the sponge or dough will thus increase, provided its surface and surrounding circumstances are such that the developed heat is not evaporated to the air, as often is the case. Heat thus makes heat, as money makes money. Extra heat has more effect on speed and production of change than extra yeast, provided the latter is already normal, but extra heat or extra yeast food is of less effect than extra yeast when the latter is low.

One of the chief reasons for failure when starting with off-hand doughs is the forgetting of the above and adding too little yeast, and also the forgetting that there has been no sponge, and then not sufficiently kneading the dough in order to clear it, or handling it sufficiently after throwing out of trough. Although some labour and time is saved, especially that of breaking up the sponge and the details appertaining thereto, a loaf to be well finished can well do with some of the labour that was saved, by having no sponge, applied to it during dough-making and after. With better flour than formerly, with more reliable yeast, with yeast in a more concentrated form, with machinery, with the tendency for larger trades, with higher wages, shorter hours, and with more difficulty to get space in large towns, the simplifying of manufacture is not only more possible, more convenient to the rest and recreation of the men, and to the master who does not want his bakery occupied at all hours of the day and night for one day's work; but is also imperative from a question of cost. This is true because, except in an exceptionally well-organised factory, it will always be found that the reduplication of stages during manufacture leads to loss of time and less ease in getting out the quantity of sacks per man, that is, more bustle with less result, the appearance of more work than indicated by the quantity of product.

In spite of several expressions of opinion, that are not always borne out by facts, concerning dryness, yield, colour, volume, and pile, that are dealt with fully elsewhere, very few who try short straight doughs ever return to their former longer systems. Inasmuch as the majority of English prize bread is made from short methods, it is certain the latter are capable of the best of quality, and in order for this to be experienced in daily commercial operations the one thing needed is precision. It is obvious that the quicker the method, the more is the need of precision and close attention to details, the same as with an express train compared with a luggage one; but with the many modern appliances and materials that leave less and less to chance, and by keeping a careful record of the details of each day's work, which becomes easily done when once started, this necessary precision is not unobtainable. In days of mere guess work it has been found handy to have a dough on which to rely, so as to correct any errors made in the sponge, but in these more advanced days there is no excuse for such errors. One cannot, however, successfully revolutionise one's system in a day, and in order to be successful both as regards getting the system right, and also as regards satisfying customers who are always suspicious and fault-finding concerning alterations, it is necessary to make any change by very gradual stages, comparing results day by day.

The number of loaves discussed, and the number of methods, and also the varieties of the methods given, are fairly well in proportion to, and representative of, those received from the different places. It will be seen that every county in England is represented, and that the national loaf from the Midlands to the South is undoubtedly the crusty cottage, other crusty sorts and tin loaves are less numerous, and the crumby ones comparatively extinct. Further North, as in Lancashire particularly, and the coast of Yorkshire, the majority, on the contrary, are of the tin variety, and Lancashire very easily comes first, as having sent the highest average quality of any county. In Scotland, as here, there are many sorts, and, although there are "French" loaves and pans, the cottage is very decidedly in the minority, and the full-faced, crumby all round, is distinctly typical. The Scotch cottages are more "squatty" and with bigger heads than ours, paler, and similar in many respects to the Welsh cottage, as illustrated; they are, although more spread, bigger and lighter than ours, less highly baked but smooth and short in crust, less sweet and more salt. It is necessary to here study the illustrations inserted throughout the book in order to better understand these and following remarks.

Ireland, especially in the north, is more similar in style to Scotland than England, and has big and highly fermented bread, and a good deal of crumby. As a rule, its bread is from tighter dough than Scotland, less highly fermented and less well finished. The crumby, plain, or batch loaf in the north is not of the oblong Scotch shape, but often with four square sides, more like the rapidly departing London household or crumby. The crumby in other parts is long and narrow; in Dublin, where tight doughs rule, it is unique, being most usually hexagonal, or six-sided, which sides are not greased like in many of the other districts. In the South of Ireland the crumby is usually of the turnover shape, moulded in one piece, something after the style of the Scotch French, but more particularly that of Guernsey. Other shapes are occasionally received. The pans are like Scotch pans, and not like so-called English tins. As in Scotland, the crumby is the rule and the cottage very exceptional, but almost everywhere crusty shapes, which are usually made from shorter systems, are decidedly gaining ground. Crust and sweetness is bound to prevail in the future. The Welsh cottage loaf is more like that of the county districts in the Midlands of England. As a rule, it is whiter, firmer, closer, smaller, more dumpy, more cakey, delicious, and shorter in eating than cottages in the South of England.

Straight doughs have made far more progress in the districts just indicated as crusty. They are rapidly becoming the chief method in such districts, but in Scotland they are as yet very much the exception, being, comparatively, scarcely used for any but fancy or pan breads. We have had some failures from there, but success will in time become more general. From both the North and South of Ireland, however, we have received some excellent plain or crumby loaves, first cousins to the Scotch sorts, and suitable to Scotch trade, from straight doughs and short processes. In Dublin (more central Ireland) we know only one firm that adopts straight doughs, and fifteen who do not, the conditions of labour and the difficulty of altering being at present the chief deterrent. In the South of Ireland particularly, we have correspondents who say they are pleased with a good trial at what is almost a new system to them, and will never return to their former ten, twelve, and fourteen-hour sponges.

England now chiefly uses distillers' compressed yeast and small quantities of salt; the supporters of patent, or home-made, and brewers' yeast are quickly succumbing to the march of progress; they are being swept in, although all the time they say, curiously, they prefer the old. Distillers' yeast, with, however, larger quantities of salt (less salt than in Scotland) and longer times than in England, has made fair progress in Ireland, and more so than in some parts of Scotland, but is destined to gradually, even in the latter country, supplant all others. At present the way is blocked by Glasgow's example, for similar reasons as at Dublin. As distillery yeast supplants the barms, so will methods of bread-making become quicker. This yeast in other parts of Scotland is becoming fairly general, but chiefly for use in the half-sponge system, and will make the adoption of straight doughs far more easy than any other. Straight doughs are perfectly possible with Parisian and compound barm, but the uncertainty of the strength and condition of the latter, and other reasons, do not allow it to compare so favourably for this purpose.

Straight doughs, by usually extending over shorter periods, are not so subject to be affected by climatic changes, but of course cannot be so easily corrected as longer and divided processes. The greater evaporation, which, however, is largely water, during a long process than during a short, is dealt with elsewhere. As yeast is composed largely of nitrogen or proteid matter, it is obvious that it must consume this and get it from the flour when growing, and reproducing itself, but in straight doughs, especially when short, the consumption must be very small. As a rule, also, there would be less skin and scraps with a shorter or single stage. Some fail by using flour too harsh, instead of nicely mellowed, for the less time and fermentation given.

A ferment strictly speaking is any body capable of setting up fermentation, and the latter is a chemical change connected with and inseparable from micro-organisms. Yeast is therefore a ferment, but in bakers' language the latter is a stage of bread-making preliminary to a sponge or dough. It is more correctly a decoction of flour, potatoes, sugar or other matters in which a ferment (yeast) has been set to grow. The primary object of a ferment is to increase the quantity of yeast, and the best conditions for this are described under yeast manufacture. With home-made and brewers' yeast it is more essential than with distillers', because sufficiently large quantities of the former cannot initially be so easily added to the batch as of the latter. The home-made or compound barm, by being usually weaker or less concentrated, will require longer to ferment than the brewers' ; but, although some ferments have been all right up to thirteen hours or so when containing no potato skins, five or six hours should be fully enough for all-round results, and three hours or less can be given according to conditions.

Although a ferment, being slack, soon rises with a cauliflower head as it should, and soon falls, it merely settles down, and does not cease to work (as some seem to think, unless kicked or disturbed), but often develops a bad flavour which is communicated to the loaf, that may look, and even smell, perfectly healthy. The acidity may be developed in the ferment, although the flour in the dough may not be overchanged. The heat when finished setting should not be above or much below 80 to 85 degs. F., and, if stood in a moderately warm and draught-less place, it should not be covered except by a wire sieve to prevent anything falling into it. The case of a barm or ferment standing a long time as in Scotland would be different. The rapidity or otherwise with which it is working can be conveniently ascertained, in addition to the bubbling and frothy appearance of the surface, by holding over it a lighted taper or a match which will be affected and extinguished according to the amount of gas being evolved. As that particular gas is heavier than air, there will always be a certain amount of it lodged in the tub if the latter be deep or not fairly filled with the ferment.

A ferment should usually contain only a small proportion of the total liquor, all the yeast, no salt or lard, all such yeast foods as potatoes, sugar, malt extract, glucose or scalded flour, which are considered under special chapters, and a small portion of raw or ordinary flour, because of the body it gives and its albuminoids, its enzymes or unorganised ferments. The raw flour thus added should be a soft kind, as it works more rapidly and makes a better head; and in Scotland, where the system of barms is more general, there are soft flours specially supplied for this purpose. In the case of a small batch of buns where the ferment liquor would be small and the sugar large, a part of the latter should be reserved till the dough stage, as too much checks the yeast. In a very strong solution of sugar, say about 50 per cent., yeast would not ferment at all, but be preserved. With a brewers' yeast ferment it is also often advisable to add a little distillers' yeast at the dough stage, therefore not all the yeast in the ferment as stated. One can also add, often with good results, a soft flour that has been baked, by putting into a slack oven on a baking-tin, and turning over as soon as pale baked and then sifting before using. The objection to this, however, is that it often gets overbaked and of bad colour; it is of course very digestive, and the basis of many infants' and special foods, and could often be turned to account by a pushing baker.

A ferment is handy as giving one a reliable test as to the state of one's yeast, before adding all the flour of the batch, after which it is difficult to add any other fresh yeast. Where the yeast, however, has been forgotten, we have known all of it to be added after dough-making, by making a thick batter of the yeast, and plastering it over the dough cut up into many small pieces, and then kneaded and allowed to prove in trough as usual; this is better than throwing the dissolved yeast on the completed and whole dough all at once, and making a sloppy mess. A ferment, by developing and getting the yeast into a vigorous state, will often save time in the dough, when one does not want to use a lot of yeast and hot water for a quick dough right off, which otherwise would be necessary. As one also gets a good power of fermentation, and can have without great heat a short time in dough, therefore short time in contact with flour, the process of ferment and dough is a good one for mellow and softer kinds of flour and for busy trades without much bakery room. With ferment and dough, or with straight doughs with, say, 3 lbs. of yeast per sack, it is possible, as in an actual instance known, to do an enormous trade in an exceptionally small space; there is not a trough on the premises, except a series of machine kneaders, which occupy no floor space, because suspended from ceiling, and there would not be room for a tithe of the troughs often required, especially when the oven drawplates are out. In all cases the individual element is a controlling factor, and most of the recognised methods being good, successful bread-making is more often due to the masterful mind that grasps all the circumstances, and knows all the points, rather than the slavish following of any stereotyped method.

The sponge is another preliminary stage to the finished dough, but is losing popularity in most districts. It still, however, plays a very important part in the Scottish system, and is more successfully manipulated there than in any other part of the world. In England, especially in London, it used to be universal to have the three stages of ferment, sponge and dough, and this method had its advantages when using patent or home-made yeast, or the "thick" or liquid brewery yeast, but now there is seldom a ferment at same time as a sponge. The most usual method is now fast becoming that of straight dough, which as seen by the tables has enormously increased of late, then sponge and dough, then ferment and dough. Sponges in England are sometimes of a batter or thin consistency, and of short or "flying" duration, of an hour or less, but more usually they are of stiff consistency and of about eight hours' duration, with, less usually, an hour or two either more or less. Although generally stiff, there is hardly any rule as to their size or proportion to the whole batch; they would usually contain about half the total liquor, and, being very little slacker than a dough, about half the total flour, but by a haphazard style they will often be much less than half.

In Scotland and Ireland the sponges are far more uniform than in England, and are divided principally into quarter and half sponges, being respectively quarter and half the total liquor. The so-called quarter and half, however, is respectively very often a fifth and three-fifths, being varied to suit convenience, and is usually larger if making crusty and cottage bread, and in a series of batches the first quarter is best larger than the second. The quarter, which lies for twelve to fourteen hours and occasionally sixteen, is usually stirred in tubs, such as is known in the south as a ferment tub, and is of moderate stiffness, and stiffer than the short sponge into which it is made before being made into a dough. It should be kept well covered if only a small one, or in cool weather, so that the liquor added to it for the next stage, or big sponge, need not be so hot. The two sponges for one batch may seem a little strange to the south countryman, and do not correspond to the slack ferment and the tight sponge of the South, inasmuch as they also sometimes are both employed in same batch with distillers' yeast—about 4 or 5 ozs. to sack—although the primary reason of them was, as in the ferment and sponge, undoubtedly to grow the home-made or Parisian barm. There is also a ferment, sponge and dough system adopted in Scotland, as given in the tables. As also seen by the tables, salt is added even to the quarter, the amounts being given in three figures to indicate the additions respectively at the quarter, "the" sponge and dough. The hard, strong or spring wheat, flour is added to the quarter, and the sponge (the second sponge is usually called "the" sponge) and the soft and good coloured to the dough, the flours there being as a rule, but not always and necessarily so, much more kept distinct and classified than in the South, where sponging and doughing flours are more often blended together and used indiscriminately for each stage.

One of the advantages of the sponge system has been claimed to be the greater facility offered for using very divergent varieties of flour, although if different varieties be blended for offhand dough and allowed to stand blended together for some days, they quickly assimilate to one another. The coarser and darker flours need, and will stand a longer and more elaborate system of fermentation to bring out their colour by bleaching, as they will be dark if immature, and also to prevent them making the bread harsh, flinty, foxy, dry or chippy. A soft flour on the other hand, wants to be worked moderately quick and warm, but not excessively so. Where any lard or malt extract is in the bread it would not, especially the former, be usually used in the quarter, although a little sugar can be. The temperature is usually given as that of the water and not of the quarter when finished, and in a series of batches, the second quarter, according, of course, to its size and other individual conditions, should have its water 10 degs. cooler, or be, say, 5 degs. cooler when finished mixing.

The extent of ripeness must depend on the flour and what is to follow, and the drop of a sponge is not always a criterion of its ripeness, because a small, tight sponge in a deep, narrow trough would have considerable difficulty in falling, but a quarter should always have a slight drop when taken, and even to the second or third time. With distillers' yeast an inch would be enough, or even with compound barm, but with other barms anything from 2 to 9 inches can be given, the smaller drop needing warmer liquor when making into big sponge. The drop, of course, depends on the consistency, and in some places the quarter is slack and in others tight. The quarter system is usually adopted in the West of Scotland and in factories such as at Glasgow, being liked in large trades but sometimes adopted in small, and is associated with fuller volume than the half sponge on the East Coast, and has the perfection of texture and an exceedingly white and bleached, not yellow, crumb. This bleached or white crumb is usually further shown up and contrasted by a very deep and nearly black, but not burnt, top crust colour, obtained otherwise than by hot oven.

Difference of opinion runs very high on the relative advantages of the two systems, the half sponge, which is more often adopted in smaller towns and villages and on the East or Edinburgh side, being considered better for flavour, but it is to be noted that the Champion Cup has three times gone to the same small town on the West and also usually to the West. The champion has also been won with high marks for flavour when the bread was made from distillers' yeast instead of the sometimes almost worshipped Parisian barm, which, like patent and brewers' yeast, is supposed and thought by some to be unapproachable in this respect. Although all Scotch bread made on these lines must contain a good amount of alcohol (there is said to be about half a gallon in 300 quarterns) and also acid, which south countrymen always call sour, the fermentation is usually well managed, especially considering the previous barm stage, and not so very often accompanied by that repulsive sourness often obtained from comparatively short sponges, say, a total of ten hours, in other parts.

The big sponge that follows a quarter (being well broken to consistency nearly of milk) is usually about half of total flour and nearly the whole of the water, making a batter like porridge, but not too thin (some have it fairly thick), as its ripeness is harder to judge, and when commencing to drop in about one and a half hours it is ready for doughing. The better the stirring the better the sponge rises, and under normal circumstances it should have risen about a foot, and be taken when just beginning to fall in the centre and not at the sides. The stirring is not nice work, and is sometimes done only on top of tub, instead of getting to the bottom, and machinery is especially to be recommended for the purpose. The temperature depends on ripeness and size of the quarter, the strength of the flour, and time, etc., and the variations for the different months and conditions, as will be seen in the tables, to which these remarks here are only intended as supplementary where explanation is useful. A good average, however, according to the month (excluding extremes), is 80 to 90 degs. F. for the water, always being much cooler than in the South, for the quarter, the sponge or for the dough. In a series of batches, as in the quarters, the second sponge should not only be about 10 degs. cooler in liquor, but also thinner or slacker. If sponge is well risen, it will not be necessary to wait for a fall, especially where the quarter was ripe, but where the quarter was young, or where the sponge is a half one and not preceded by a quarter, it should fall. According to the amount of strong flour used, or the amount of softer mixed with it, and the ripeness of sponge, the dough can usually be short, and, to some extent, can adjust too little or too much maturity allowed previously.

The half sponge, not preceded by a quarter, is now becoming more general, especially on the East side with the gradual spreading of the use of distillers' yeast. It is made moderately tight, the last thing when the men leave at night, usually at 5 P.M., and taken when they come at 5 A.M., being twelve hours with 8 ozs. of yeast per sack, and a quarter of the total salt, namely, about 1½ lbs. out of 6 lbs. to the sack, and more in warm weather. Although the first of a series of sponges when taken should be well risen with bubbles of gas coming off and breaking rapidly, the gas should not be coming off too rapidly, as if like boiling, and the next sponges should, of course, be less free.

The time of dough following these Scotch sponges, of course, varies according to conditions, as given in tables, but a good time is four hours after doughing till oven. If too long, loaf gets rank and crumbles in centre and loses flavour; and if too short, is small, uneven, and perhaps close and foxy. One should judge whether dough feels short or tenacious. Some cut back at first rise and take at second. If a quarter has been employed the dough can be made slacker than if following a half sponge, and the bigger the proportion of liquor left for dough stage the longer the dough will be ripening.

Sponges in England are usually, practically always, although we have seen them otherwise, made in troughs and not in tubs, and they are usually stirred, and broken up for dough-making, by hand and not by the special vertical sponge stirrers used in Scotland. The breaking is a very important part if holes in the bread are to be avoided, and this frequently takes much time when well done in a large trade. We have just seen twenty minutes over one sponge thus occupied, and two men took one hour to break the sponge and make it into 15 bushels of dough. Even if a sponge is stirred when a dough-making machine is used, it is not necessary to break the sponge in such a case, as the machine will succeed in well amalgamating the whole in far less time than necessary for the breaking alone. If the sponge is to ferment a long time, it should be only a small one, and have salt like the Scotch quarter. If it has a greasy, slimy, and wet, instead of a healthy dry, appearance all along the trough, it will have been too slow, with insufficient yeast, or cold, and is unready. Instead, however, of waiting longer, it should be taken and made into dough, with extra heat and also with additional yeast, and can thus be better compensated. When thus unripe it will probably have a smooth, uncracked, and rounded surface, and be resisting to the arm when pushed in, instead of breaking open or falling in with a rent when touched, and puffing off gas with a kind of hissing, and a piece will also be tough to pull in the fingers instead of breaking short.

We have taken plenty of distillers' yeast sponges without allowing them to drop, and with no harm. With distillers' or dried yeast, there is usually enough yeast and to spare, and temperature in a subsequent stage —the dough—will usually make up for any little backwardness in the sponge, when the latter is judged as to its readiness by its drop. We know of sponges that have been over-ripe, and have not dropped, and, on the other hand, it is not impossible for a fairly slack one to be over-stimulated by heat, giving off gas rapidly for a while and then falling, but without sufficient power and size and yeast growth to carry the subsequent dough in the usual time. One drop is enough for distillers' yeast, but patent and brewers' are better with a second or taken on the second turn. A strong flour, like an American, or a very stable one, although not necessarily of coarse strength, like Hungarian, will not drop so easily as a softer. A sponge should not be tight, especially with a strong flour, and will get ready sooner when slack.

The softer the flour, and therefore more rapid the degradation, the smaller the sponge should be, so as to save the loaf from looking poor. Sponges usually being longer than doughs, the rule is to put the strong flour there, but in the case of short or flying sponges, the soft should be used, as being more rapid and also easier to break up when making dough. Small sponges are always best for flavour, by being usually less changed and leaving more sweet flour for the dough. If a sponge is over ripe, it should not be taken up cold and starved, as often done, but will make sweeter and better bread if taken warm with more yeast and then dough thrown out sooner than usual. We have before us some tables prepared at various times for guidance in taking up liquors for setting sponges, or making doughs, according to the time to be given and the heat of the atmosphere. These are best prepared for each bakery according to the conditions ruling, the consistency of sponge, amount of yeast, etc. There are also instruments sold for automatically indicating the variation required in the liquor, according to the rise or fall of the temperature of the air and mercury. Taking figures at random from a table we once prepared for sponges for a large firm, we see a sponge to be ready in twelve hours should have liquor 3 degs. cooler than for eleven hours with the atmospheric temperature at 60. Also with the latter at 62 the liquor should be 2 degs. cooler in each case.

We have already said that the remarks under this section are intended as merely supplementary and for the purpose of explaining, and connecting, the facts mentioned in the accompanying series of tabulated methods. One of the objects of giving those many methods is to show the different ways in which similar results have been obtained, in which practically anything can be done to suit individual circumstances and requirements. This should be borne in mind in connection with the sponge-setting tables just referred to, and is further emphasised by an interesting letter, answered by us some time ago, that has just again come under notice, and is worth reproducing. It is as follows, and, to some extent, answers itself:—"*Re* the quick method of fermentation advocated in your letters, will you kindly reconcile the apparent differences between experts? Taking them in alphabetical order, Mr John Blandy (No. 1) gives, in his article on the 'Seven Phases of a Loaf,' the recipe: 280 lbs. flour, 2½ lbs. yeast, 2¼ lbs. salt, water 110 degs. F., manhood stage four and a half hours, maturity six hours. Mr Jago (No. 2), at National Association Conference, two years ago, gave 280 lbs. flour, 19 ozs. yeast, 3 lbs. salt, water 95 degs. F., dough to lie three and three-quarter hours. Mr Owen Simmons (see process No. 3 given in the table a few pages further on), in a booklet written for a firm of yeast and malt extract manufacturers, gave, amongst others, 280 lbs. flour, 1½ lbs. yeast, 1 lb. malt extract, 2½ lbs. salt, water 115 degs. F. (in large iron machine) dough to lie two and a half hours. Mr Jago said that three and a half to three and three-quarter hours was the shortest time to give the dough, even with more yeast, to obtain a satisfactory (cottage) loaf, and Owen and Owen seem, as I understand them, to endorse this, but in other letters give recipes for an hour less than Mr Jago said was required. What, in your opinion, is the shortest time I can get a batch in the oven with, say, 3 lbs. or 3½ lbs. yeast, cottage bread? You mentioned in a recent letter that *some* firms use 3½ lbs. yeast to sack. I have made up small lots of 'Hovis' and 'Eurissa,' and put in oven under the hour, but that, of course, was tin bread, and very slack dough." This is the letter from beginning to end, and it shows we have at least one man who studies his trade.

Let us give two test batches that have recently claimed our attention. The first we give (No. 4) was made at the Borough Polytechnic Bakery, in sight of three of the above experts, by a very celebrated prize-winner. Two bushels best flour, 2 lbs. yeast, 2 ozs. malt extract, 60 lbs. water (6 gallons), 23 ozs. salt, flour was 56 degs. F., water was 115 degs. F., and when mixed the dough was 82 degs. F. Quarter of an hour afterwards the dough was 85 degs. F., and after another hour it was 88 degs. F. This was hand-made at 5.15, and was in the oven at 7.35 (two hours and twenty minutes). This was a small batch of about eighty half-quarterns of beautiful bread. It was good size, but a few minutes longer on the boards would have been liked by some of those who saw it; most of those present, however, bought and took away a loaf or two at 3d. each. Another batch (No. 5) of a sack capacity was 91 degs. F. when finished kneading, yeast 1¼ lbs., salt 3¼ lbs., four hours in trough. This was very ripe, and large, and fermented as fully as one dare go. The materials were good, and the oven was very hot, and the loaf was excellent. Had the oven been cooler, and the materials less stable, the freeness and fermentation would have shown themselves to have been excessive.

We can vouch for all the five recipes for off-hand or straight-off doughs given above, although, as far as they go, all different, being good enough for good bread. No *absolute* recipe can be given—we find this difficulty when briefly writing correspondents—unless accompanied by very full particulars concerning the various other conditions that govern the speed of the maturity of dough. Even if the temperature of the water be given, that is not always a criterion of what the dough will be when kneaded, or what its mean temperature will be for all the time it is in the trough; the temperature of the flour, the temperature of the atmosphere, varying hourly, therefore the temperature of the troughs, etc. Not only is the time and heat affected by the season of the year, but also by the quality, character, and quantity of flour used. A slack dough comes along, of course, faster than a tight, and so does a weak flour faster than a strong. The time in trough and the heat in trough does not say how long it will be on the boards, or the heat it will be on the boards, and when recipes are given, as some of the above are, from actual tests made, these particulars have often affected. The style of bread also affects; the more labour put into it, the more the fermentation will be checked.

By reading and comparing recipes of some of the best loaves sent us, one will see they vary in their quantities of yeast and heats and times, although made mostly by the off-hand process. We will tabulate a few of the best—all off-hand doughs—taken entirely at random, being the first that catch our eye in looking through the list. Nos. 1 to 5 inclusive are the five recipes already given above. No. 6 is a batch from which we saw an excellent loaf; it was good size as large as required, cut well, and splendid to eat; it was made because the bread order had been cut too short. No. 7 is a Bristol loaf, that for a long time was the best loaf we received, and earned a total of ninety-two marks; it had nineteen each for crust colour, flavour, and volume, eighteen for crumb colour, and seventeen for texture. No. 8 is a loaf that obtained even more marks, having won ninety-five. No. 9 is a Liverpool loaf—eighty marks. No. 10 is a Blackpool loaf, which was awarded eighty-eight marks. No. 11 is a Bolton loaf, which received eighty-seven marks. Where particulars give the time only up to throwing out, we have added one hour and a half to represent the time required from throwing out until commencing to set, so as to make all the times comparative, and we have deducted forty-five minutes where the time included baking.

	Flour.	Yeast and Yeast Food.	Salt.	Water.	From Start to Oven Setting.
1	5 bush.	2½ lb.	2¼ lb.	110° F.	4½ to 6 hours
2	5 "	1¼ lb.	3 lb.	95° F.	5¼ hours
3	5 "	1½ lb. 1 lb. ext.	2½ lb.	115° F. 85-90 mixed	4 "
4	2 "	2 lb. 2 oz. ext.	1½ lb.	115° F. 82 "	2¼ "
5	5 "	1¼ lb.	3¼ lb.	91 "	5½ "
6	2 "	1 lb.	¾ lb.	110° F. 86 "	2½ "
7	5 "	1¾ lb. 12 oz. ext.	3 lb.	113° F.	4 "
8	5 "	2½ lb.	3½ lb.	115 (flour 60° F.)	3¾ "
9	5 "	2 lb.	3 lb.	98 (flour 70° F.)	4¾ "
10	5 "	2 lb. 10 oz. ext.	3 lb.	95° F.	4¼ "
11	5 "	2¾ lb.	3¾ lb.	—	3¾ "

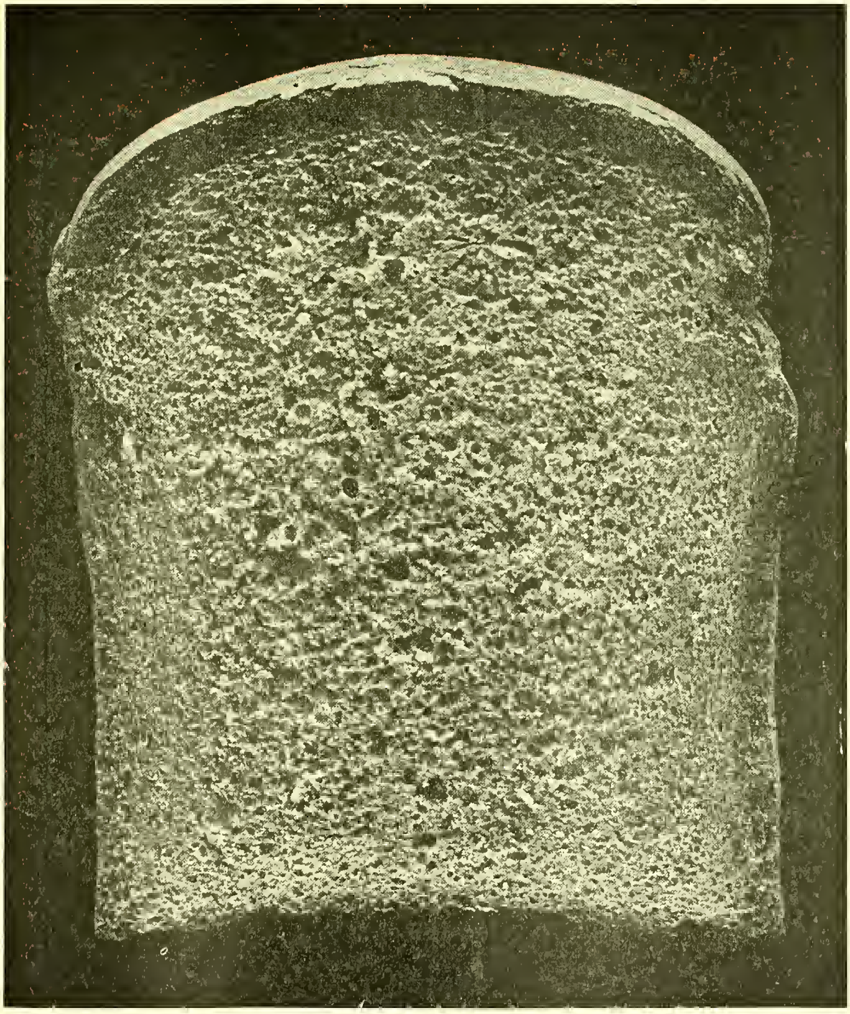
These figures will repay comparing and studying. All the processes given will produce, and have produced, good bread. The room in which we are now writing, at 11 P.M., is, with all the windows open, 80 degs. F., whereas we have frequently seen the same thermometer in the same place at 45 degs. F. This is quite sufficient to alone account for any differences in the maturing of various doughs, although at the same temperature when kneaded. It should be noticed how closely the good loaf made by No. 7 runs to No. 3. The latter has slightly less yeast, but, on the other hand, it has more malt extract and less salt. Nos. 4 and 6 were actual batches, witnessed by the writer, and made respectively in winter and summer. There is a big difference in the yeast there, showing, as we have said before, how extremely important is the heat, more so than the yeast, provided there is already a reasonable quantity of the latter. Extra heat has more effect than extra yeast. It can be seen that these two were made at different seasons, because, although the water is hotter in the one case, the dough is cooler when mixed, showing that the flour and utensils more than compensated for the extra heat in water, also indicating that the atmosphere was cooler, and that the tendency for the temperature of the dough to increase while fermenting would be more severely checked. The temperature of the dough when mixed, and also the mean temperature of the bakehouse, is, therefore, a more important criterion than the temperature of the liquor used, and many recipes do not give this.

We have read somewhere that there are rather over 100,000 bakers in the United Kingdom of which about one-fifth are masters and, by-the-bye, less than 1000 first-class roller mills. The bakers are distributed into about 85,000 in England and Wales, 19,000 in Scotland, and 3000 in Ireland, it may seem therefore that, in these supplementary notes, we are giving Scotland and Ireland undue prominence, but their systems are longer, and more intricate, and the smaller number of methods given in the tables do not allow so much space for inserting this fuller information. It would not be necessary, however, to apologise even if giving prominence to the smaller number, because one usually wants to read about that which one does not know so much, and, especially in the baking trade, much information can be obtained by thinking out the doings and the principles underlying the results of others. Much can be learned from Scotland. We should say that the Scotch bakers, as a whole, possess and show in their bread a higher general average of skill and intelligence than the bakers of any other district in the Kingdom, not excepting Lancashire already mentioned for good tin bread. Although a certain Australian correspondent, who made a point of recently calling on us here, was surprised to find the writer possessed so few grey hairs, we have an unusually intimate acquaintance with the breads, and with the peoples, of all districts of this country as well as of all the chief parts of the world, and make the above statement only after consideration.

Although always pleased to answer, as a matter of business, any inquiries for information, we have been frequently surprised at the extraordinary and incomprehensible lack of knowledge of many who are engaged in the trade, but we get far less of that sort of thing from Scotland than from anywhere. In spite, however, of the skill and comparatively greater general knowledge of the trade usually displayed, the goods produced are certainly more for the eye than the palate. There are nearly as many Scotchmen in England as in Scotland, but we never get an inquiry from England for Scotch bread, but often get an inquiry for English bread from Scotland. Englishmen do not like Scotch bread, and attempts to sell it in England have not been so successful as contemplated. We intimately know many Scotchmen in London, many of them are very prominent, and do large trades here; and just recently, as before, one of them returning here after a visit to his native highland country, remarked what a treat it was to now get some bread—the London—that he could eat. At the exhibitions one finds colour, pile, texture, volume (last year's champion, a plain, was 6¾ inches long, 3½ broad, and 6½ high when a week old), yield, and moisture are usually very good; and the extent to which these points are valued may be gauged by the fact that the maximum of fifty marks has been divided by the judges into five for crust colour, ten for crumb colour, fifteen for flavour, ten for volume, and ten for texture, whereas the maximum of a hundred taken by the English judges, has been divided recently into four divisions of twenty-five each for colour, flavour, volume, and texture. The Scotch crust colour is taken at a low maximum, because there is a good deal of difference in the custom of different parts, that of the west coast being of a darker character than that of the east, and, of course, in a Scotch plain, there is not a vestige of crust anywhere but top and bottom, the sides being completely crumby.

These crumby sides, that is, all the outsides of each pair of half-quarterns or half "loaves" (a "loaf" is a quartern) are greased with a brush with melted lard, or some vegetable oil—mineral oil should not be used—to make the sides part smoothly and easily, the only rough side being the one next to the other half loaf. This is also done in some parts of Ireland, but hardly ever in England, at least not for the ordinary run of English crumby bread, we knowing of only a few exceptions. This greasing not only improves the appearance of sides by causing them to part more smoothly, but also makes a large batch of crumby much easier to draw from oven. Some setters have an assistant with a brush, others have a tin of melted butter or lard on the oven stock, and dip their hands into it, applying, in that case, at last moment when on peel. The plain loaves that give the good pile and volume (they are usually smaller on the east coast than the west) are from slacker doughs than the smaller proportion of Scotch crusty, such as Coburg and cottage. The smaller proportion of the latter received and seen are very different to the English cottage, they are bigger, lighter, shorter, riper, more salted, and with smooth pale crust, indicative of longer fermentation and lard. The French loaves are not like the bread usually called French elsewhere, such as rolls and small bread and crusty all round, but are, as seen in the illustrations, a relation of the Guernsey shape, and originally were copied from France.

The French and pan and other crusties are fairly generally recognised by bakers and local authorities as being "fancy" and not expected to weigh 2 lbs., and do not have the weight, like many of the plain loaves, stamped



PRIZE MALTED BROWN (FULL SIZE).

or docked on their top; but pan or tin bread in England is not recognised as fancy. Like "fancy" bread in England, there is not, in all parts of Scotland, a very distinctive difference between so-called "French" and plain bread. Where there is none of the latter sold as such, the same shape even as sold elsewhere as "plain" is sometimes called "French." Like the various sorts of English bread, the two sorts, even when of different shape, are often off the same dough, and sometimes not even tightened up by more flour or added to by lard. Lard, however, is by no means always the rule. It is quite an exception in England, but not unknown. The putting of French bread in a shallow pan just before baking does not disqualify it in the competitions; but in the English Section a cottage loaf, called a pan cottage, when thus put into a pan or tin, as here called, and now getting very general, is disqualified. Crusty and fancy sorts would, be very often made by a shorter system than the ordinary, sometimes in three or four hours. The cookies, which are a sort of bun, are often taken off the sponge before adding all the salt, and then sugar, and shortening is added. This finishes all we can, in this chapter, say concerning Scotch bread.

As this chapter, the reader must be again reminded, is merely supplementary to the 360 tabulated methods, which should be read first, there is very little to say concerning wholemeal, brown, fancy, milk, and other breads, in addition to what is said there, and also under other important chapters, such as that on digestion of bread. A very common error, however, is to make wholemeal dough too sloppy, and then bake it slowly for a long time. There is no advantage, in fact, on the contrary, in adding water which is in excess, and must therefore, in order to prevent clamminess, be afterwards driven off in the oven. The common practice of baking meal much longer than white bread is distinctly wrong, and has only come about by making doughs too slack, or rather not tightening them up sufficiently after first making. Wholemeal made only like a slack dough, and then put into oven almost last, as it usually is in a mixed batch, should be ready for drawing in nearly the same time as the white bread, instead of being shifted and given longer baking. The quicker it is made, handled, and then baked, the better, and, as it does not burn as soon as white, there is no better place for it, in the case of the side-flue ovens, than near the furnace. Although left in longer usually than white, it is more usually undersoaked, and this is due often, not only to the excessively slack dough, but also to an excess of malt extract—this has been noticed particularly at the exhibitions. When golden syrup is added, which is good for a change, and which is more refined, and therefore with less impurities and possible bad flavour than the similar substance known as treacle, there should be no malt extract, although, of course, the amount depends on the system of fermentation, and the amount of yeast added for consuming it and preventing the stickiness. The stickiness will decrease the longer the dough is left.

Hot water, and plenty of yeast, and short time is the secret of good brown bread; the latter comes along more quickly and undergoes undesirable changes in flavour quicker than white, because of the ferments in the bran and the presence of more impurities. If the meal is not strong, and sometimes anything is considered good enough for meal, too much proof in the tin, which is always to be avoided, causes the crumb to sink in the centre, making heaviness in one place and a large hole just under the crust. Although a loaf is not "wholemeal" if any white flour is added to it, the latter is frequently an improvement from a saleable standpoint. This point wants watching as regards inspectors and exhibitions. The safest plan is to sell the bread as "brown," and not "wholemeal," and this is very much more frequently necessary than many consider. Quite recently there have been several prosecutions and convictions for selling a perfectly good and wholesome article merely by a wrong name. Wheaten flour is, of course, flour made from wheat, but some assistants, when asked for it, have thought brown meal or wheat meal was meant, and on supplying such have found themselves branded like felons. A certain so-called wholemeal which has come under our notice as being much liked by bakers, and in preference to others of the district, we know to be made by the miller adding 25 per cent. of offal to an ordinary good sack of flour. It is a fine meal, and works well. This, of course, may be due to the fact that many millers—not all—do not make their meal from as good a grist of wheat as they use for their flour.

Meal, to be really good, should be made from the same wheat as the best flour, or, perhaps, one should say, from the best grist of wheat used, because best and worst flour is sometimes made from the same wheat. A fine meal, although some ask for coarse because of its irritating action on the intestines, will usually make the better cutting loaf. The latter will be often better still with a little strong flour added. When brown bread is put into a tin that is to be turned over, so that loaf is baked under the tin, one should be careful to put the closing squarely at the bottom, and not give much proof, so that the closing, when loaf is turned over, comes at the top and breaks out prettily instead of being "blind." If this closing be carelessly put at the side or not at the bottom, the pretty top is spoiled. Of course, although flavour will be improved by proving in tins less, the loaf will be correspondingly closer.

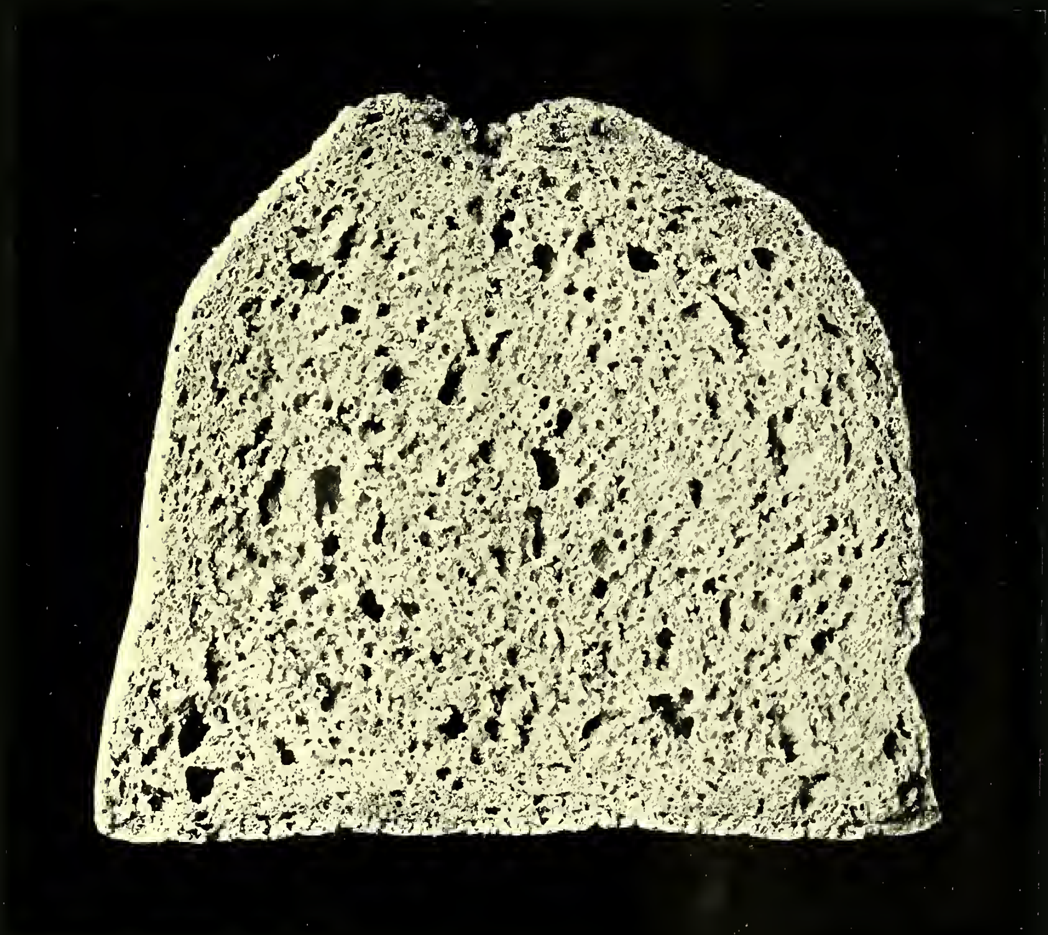
For a brown loaf, composed chiefly of rye meal and barley meal, one should take, for a small quantity, 5 lbs. rye meal, 5 lbs. barley meal, and 2 or 3 lbs. (or more) of the strongest white flour. Dissolve in a small bowl 4 ozs. yeast, 2 ozs. golden syrup, and handful of flour in small portion of water at 90 degs. Prepare bay of the meal and flour—well mixed—on the boards, take water very hot (less than a gallon altogether) and 3 ozs. of salt, partly mixed, then add the dissolved yeast; the whole when then mixed should be of medium slackness and of a temperature, as accurately shown by thermometer, of 90 degs. F. Scale at once when mixed into tins, giving about half an hour there until well risen, and then bake with ordinary batch of other browns. This is much better than dipping out of sponge. Such meal must not stand; therefore much yeast and heat is necessary. If wanted richer, take half milk, dissolving the yeast in it, and 1 oz. of lard to the quart of liquor. Rye and barley bread are a great exception in England, except in the northern counties, where in some districts, particularly Cumberland, they are rather popular. This is all that need be said here on brown breads, because we must leave proprietors of patent or special sorts to do their own advertising at their own expense.

Amongst the tabulated methods we give the essence of some of our correspondence with, and the methods by which bread has been made and received from, Guernsey (Channel Islands), Kimberley, Capetown and other places in Africa, Queensland, New South Wales and other places in Australia, New Zealand, Tasmania, Madeira, Canada, America and Gibraltar. At various other times we have also seen bread from Bombay and Calcutta in India, from Malta, from Egypt, and from practically every large town in Europe. Perhaps the chief points impressed upon us were the great differences that exist in the various products that bear the one title "bread," the great differences between the taste and the skill of the various peoples (the quality and the character of the bread in almost all cases indicating the financial prosperity and the state of civilization), and also the great differences in the keeping qualities of the various breads.

Many of the colonial breads were despatched five and six weeks before arrival here, and although still remaining quite wholesome in many cases inside, were very badly mildewed outside. Some of the European breads were about half as old, but were in more than twice the better state of preservation. The chief points to account for this would be that the majority of the colonial bread was in larger loaves and slacker baked, and also in tinned lined cases, which prevented evaporation of water and the free drying of the loaves. The European, on the other hand, consisted mostly of small loaves, more baked and with more surface of crust, and also not in tin cases, but in many instances were, on the contrary, sent in specially ventilated boxes. Bread kept in a closed earthenware pan as by some householders will certainly keep moist longer, but it will become mildewed and of bad flavour much sooner than when exposed to the air or merely wrapped in a cloth. At the present moment we have before us some half-dozen loaves that have been cut for examination; some are now very dry and cracked in the crumb, and have practically no smell nor taste, all moisture and flavour having evaporated; while some that have had their cut crumby surfaces or sections placed in contact with the crumby sections of the others are all ornamented in the centre of the crumb, where the contact was closer and the moisture less able to evaporate, with very pretty moulds. We regret to say we very often have loaves go like this in quite a few days, whereas at other times a single loaf will keep in a cloth a long while.

When going abroad, and staying in the best hotels, one often thinks how very nice is the bread, but one forgets the fascination of change and the increase in the best of all sauces—appetite—and if one, like the writer, is sufficiently interested and desirous of finding out the character of the bread of the ordinary population and lower classes, a very different state of things will often be found, and the general average will be, at any rate according to our idea, distinctly below the bread of "the people" in this country. Such has been our own personal experience and we have before us many letters that bear out this and give other useful information, such as one from Mr Jansen of Holland, and also a large pile of cuttings on this subject that from time to time have been collected and filed in their proper place for ready reference, and we propose to give some of the information obtained by supplementing, for a change, our own remarks in the tables by quoting from the *National Baker, the British Baker and the Bakers' Helper* on this interesting subject, namely, the methods of fermentation and manufacture.

For instance, in support of the above, it will be found that in the remoter parts of Sweden the poor people make and bake their rye twice a year, and store the loaves away so that eventually they are as hard as bricks. Further north still, bread is made from barley and oats. In Lapland, oats, with the inner bark of the pine, are used; the two together well ground and mixed are made into large flat cakes, cooked in a pan over the fire. In dreary Kamchatka, pine or birch bark by itself, well macerated, pounded and baked, frequently constitutes the whole of the native bread food. The Icelander scrapes the "Iceland moss" off the rocks and grinds it into fine flour, which serves both for bread and puddings. In some parts of Siberia, China and other Eastern countries, a fairly palatable bread is made from buckwheat. In parts of Italy chestnuts are cooked, ground into meal and



Section of Wheatmeal Loaf.
(ACTUAL SIZE.)

used for making bread. Durra, a variety of vanilla, is much used in the countries of India, Egypt, Arabia and Asia Minor for making bread. Rice bread is the staple food of the Chinese, Japanese, and a large portion of the inhabitants of India. In Persia the bread is made from rice-flour and milk; it is called "lawash." The Persian oven is built in the ground, about the size of a barrel, the sides being smooth masonry; the fire is built at the bottom and kept burning until the wall or sides of the oven are thoroughly heated. Enough dough to form a sheet about a foot wide and about two feet long is thrown on the bench and rolled until about as thin as sole leather, then it is taken up and tossed and rolled from one arm to the other, and thrown on a board and slapped on the side of the oven. It takes only a few moments to bake, and when baked is spread out to cool. This bread is cheap, sweet, and nourishing.

A specimen of the "hunger bread" from Armenia is made of clover seed, flax, or linseed meal, mixed with edible grass. The best thing that can be said of Armenian bread is that it will sustain life, as it is a hard dose for people accustomed to the loaves from our own bakeries. It is a case of the survival of the fittest, and a person with poor digestive organs does not last long on "ek mek," which is the Turkish name for bread, as it is not a delicacy, but a stern reality. The flour is mixed in a bowl to the consistency of dough, the dough being rolled out to the thickness of blotting paper, and placed on a padded shield, which serves instead of a pan. The back of the shield is a straight board, and over the padding is a white cloth, which makes a smooth, oblong surface, and over this the rolled dough is placed, and lowered into the "toneer" for baking. The "toneer" is a round hole fitted up with a tile interior, and is larger at the top than at the bottom; a tile pipe, through the bottom, provides a draught for the fire which is kindled in it. Great heat can be secured in this manner, and the tile soon becomes very hot, retaining its heat for a considerable time after the ashes and coals are removed. When the "toneer" has been relieved of its fire the shield is lowered by hand, and the dough slapped against the heated tile surface, requiring but a few such slaps to bake the dough, and the bread is removed from the oven, an article of food, but far from being a relish. Great quantities are cooked in this manner, at each baking enough being made to last the family from three to six months. After being removed from the oblong pad, it is hung up in the store-rooms, or stretched on lines between poles, to prevent depredations by rats. This bread resembles wheat in its apparent indestructibility, and will last for a long time, being the principal article of diet in the breadstuff department. It can truly be called a "staff of life," even if it does discriminate against dyspeptics. The Turks, in raiding Armenian households, can destroy most of the stores quite easily, but this bread is hard to destroy, hence it survives the raids and prevents, in many instances, extreme want.

In the Molucca Islands the starchy pith of the sago palm furnishes a white, floury meal. This is made up into flat, oblong loaves, which are baked in curious little ovens, each oven being divided into oblong cells to receive the loaves. Bread is also made of roots in some parts of Africa and South America. It is made from manioc tubers ; these roots are a deadly poison if eaten in the raw state, but make a good food if properly prepared. To prepare it for bread, the roots are soaked for several days in water, thus washing out the poison ; the fibres are picked out, dried and ground into flour. This is mixed with milk if obtainable, if not, water is used. The dough is formed in little round loaves, and baked in hot ashes or dried in the sun. In the Tropics the staff of life is the banana and plantain. The unripe bananas are dried in the sun and reduced to meal, and bread made from it is excellent and very nourishing. The plantain is not reduced to meal ; the ripe fruit is roasted or boiled and then eaten. There are some savage spots in the wilderness of the world where the natives consume earth as a part of their diet ; but earth-eaters in a civilised country of Europe seem an anachronism and an anomaly. Yet this is given as a fact of Sardinia at the present day.

It has been stated by Deputy Cavallotti, that "While at Galtelli they are taking the roofs off the houses to sell the tiles in order to buy oats and make them into bread, that at Ulzulei and at Baunei they eat 'earth bread.'

It seems incredible, yet it is strictly true. A hill situate in the vicinity is the granary of these two miserable hamlets. The women go there to make provision of a yellowish earth, which they infuse in water, in wooden vessels. Next they proceed to knead the residuum of mud into a paste, with the addition of a little flour ground from acorns, and put the so-called bread into an oven to bake. The loaves have all the appearance of fire-proof bricks. In the evening they mix this bread in boiling water with some strips of bacon, and place a similar mess before the labourers on their return from work, fortunate to be able to repose their weary limbs on a mat on the floor near a burning log after their frugal repast"! It must be taken for granted that men whose lives are spent in such conditions are not well disposed in their mental organisation. Hence the coarseness, the brutality, and the greater frequency of delinquency amongst the Sardinians. This is the main, indeed, the unique cause of their rancour against Continental Italians, more lucky than themselves in the gifts of fortune.

In many parts of Hungary good bread is made by the following process, without yeast. Two large handfuls of hops are boiled in 4 quarts of water; this is poured upon as much wheaten bran as it will moisten, and to this are added 4 or 5 lbs. of leaven. When this mass is warm the several ingredients are worked together till well mixed. It is then deposited in a warm place for twenty hours and afterwards divided into small pieces about the size of a hen's egg, which are dried by being placed upon a board, and exposed to a dry air, but not to the sun; when dry they are laid up for use, and may be kept for six months. The ferment thus prepared is applied in the following manner: For baking six large loaves, six handfuls of these balls are dissolved in 7 or 8 quarts of warm water; this water is poured through a sieve into one end of the bread trough, and, after it, 3 quarts of warm water, the remaining mass being well pressed out. The liquor is mixed with sufficient flour to form a mass of the size of a large loaf; this is dusted over with flour, the sieve with its contents is put upon it, and the whole covered, and left till it has risen enough, and its surface commenced to crack. This forms the leaven or sponge. Fifteen quarts of warm water, in which six handfuls of salt have been dissolved, are then poured upon it through the sieve; the necessary quantity of flour is added (after the water and leaven or sponge is well mixed), and the dough is then well kneaded. This is left, covered up for half an hour or more in a warm place. It is then formed into loaves, and left another half hour to prove, before being placed in the oven, remaining there from one to two or three hours, according to their size. The great advantage of this kind of ferment is that it may be made for use in large quantities at a time, and would be found convenient for sea voyages, etc., or for persons living at a distance from any town, and where yeast cannot be readily procured.

For the usual bread of France instead of using yeast, the start is made with a piece of dough of about 3 lbs., which is left for this purpose from the day before. This leaven is called "levain du chef," or, in short, "chef"; this is made fine in 3 quarts of water, and with additional flour worked into a medium firm sponge. In a couple of hours this is ready. As soon as it begins to drop, with 6 more quarts of water the sponge is broken fine, and more flour added. This sponge should be well worked, and a little slacker than the first sponge. This is the "levain premiere." While this is rising, the oven is heated, and when the sponge begins to drop, from 12 to 24 quarts of water with the usual amount of salt (from 6 ozs. to 8 ozs. to 12 quarts) is put into the sponge, the sponge broken fine and worked into a good tight dough. One-third of this dough is put back and penned up. This is the second sponge for the next batch of bread. The remaining dough after letting it come up for about ten minutes (given a start), is scaled right out of the trough, moulded into loaves at once, put into long cloth-lined baskets, the shape of the loaf. It is given about three-quarters proof. The oven has been scuffled out by this time, the loaf is turned upside down on to the peel, given three or four slanting cuts, put in the oven on the sole, and baked to a nice light brown colour. The French flours are mostly soft. The old dough used for the start, should either be put in a pail and 1 quart of cold water added, or more flour worked into it and rolled up into a cloth, well dusted, to keep it from getting too sour. As we do not have the baskets, it will do just as well to set the moulded loaves in cloth-lined boxes, like the Vienna, and pinch the cloth up between the loaves. A loaf made with compressed yeast with a straight dough, is very much sweeter.

The native Indian makes a leaven from sour buttermilk. The process of making the active agent is a very simple one; some flour is mixed with the milk, and a small quantity of "massala" is added. This massala is a secondary agent of a very unimportant character, except in the eyes of the Indian baker. It has been described as a relic of trade superstition, and the composition is regarded by native bakers as a trade secret. It will be thus seen that even where the trade is not highly developed, technical information is as jealously guarded in the bakehouse as what it used to be in Great Britain. Massala is formed from the following curious ingredients:—Gum mastiche, myrrh, powdered cloves, powdered nutmegs, coriander seeds, cardamoms, saffron, cinnamon, powdered liquorice root, seeds of the lotus, popcorn or parched maize, and a kind of coarse meerschaum which comes from the sea-coast, and is called "samunder sukh." Europeans in India make their bread in the following fashion:—Take some fresh toddy that is in a state of fermentation, and pour it into a bay with 2 lbs. of good, dry flour and a teaspoonful of salt. This is made into a stiff dough, and set aside to rise. The toddy is made from the date or palmyra. When palmyra is not to be had, a fermenting liquor is made by soaking fresh, dry peas in warm water until fermentation begins. This liquid is strained and is used for fermenting the dough. The Mussulman has a curious sort of leaven for raising his bread, known as "kummier." A certain quantity of aniseed is soaked in dhye for ten or twelve hours, and then strained; it is then mixed with flour and set aside to lie for a couple of hours, when it is ready for use. The native, however, who uses the massala ties up in a rag his sour milk dough, and stows it away for twelve to fifteen hours, when fermentation sets in actively. A portion of this is used to make a dough.

To make a batch of bread of 100 lbs. of flour in the Dutch manner one operates as follows:—The yeast to be used, from 1½ to 2 lbs., is previously dissolved in some lukewarm milk of about 77 degs. F. The flour is then put on one side of the kneading trough; part, about 14 lbs., is mixed with the dissolved yeast, and with as much luke-warm milk that the sponge be not too tight, about 1½ to 1¾ gallons being required, according to the quality of the flour used. When properly mixed, this sponge, which should now have a temperature of about 25 degs. C. (77 degs. F.), is made into a lump, covered and left alone for a quarter of an hour or twenty minutes. When fermentation has advanced sufficiently, this sponge is mixed with the remaining flour and milk of such a temperature that the dough when finished making is about 25 degs. C. (77 degs. F.), and in such a quantity that the necessary firmness be obtained. During the kneading from 1½ to 2 lbs. of salt are added, according to taste and quality of flour. The dough having been well kneaded, it is again made into a lump, and remains covered up for fifteen to twenty-five minutes; then the dough is made into the desired shapes, which are quite different to English, covered again and left to rise until about half the size of the loaf is attained, when the batch is put into the oven. Larger batches and those made with water instead of milk require a much smaller proportion of yeast.

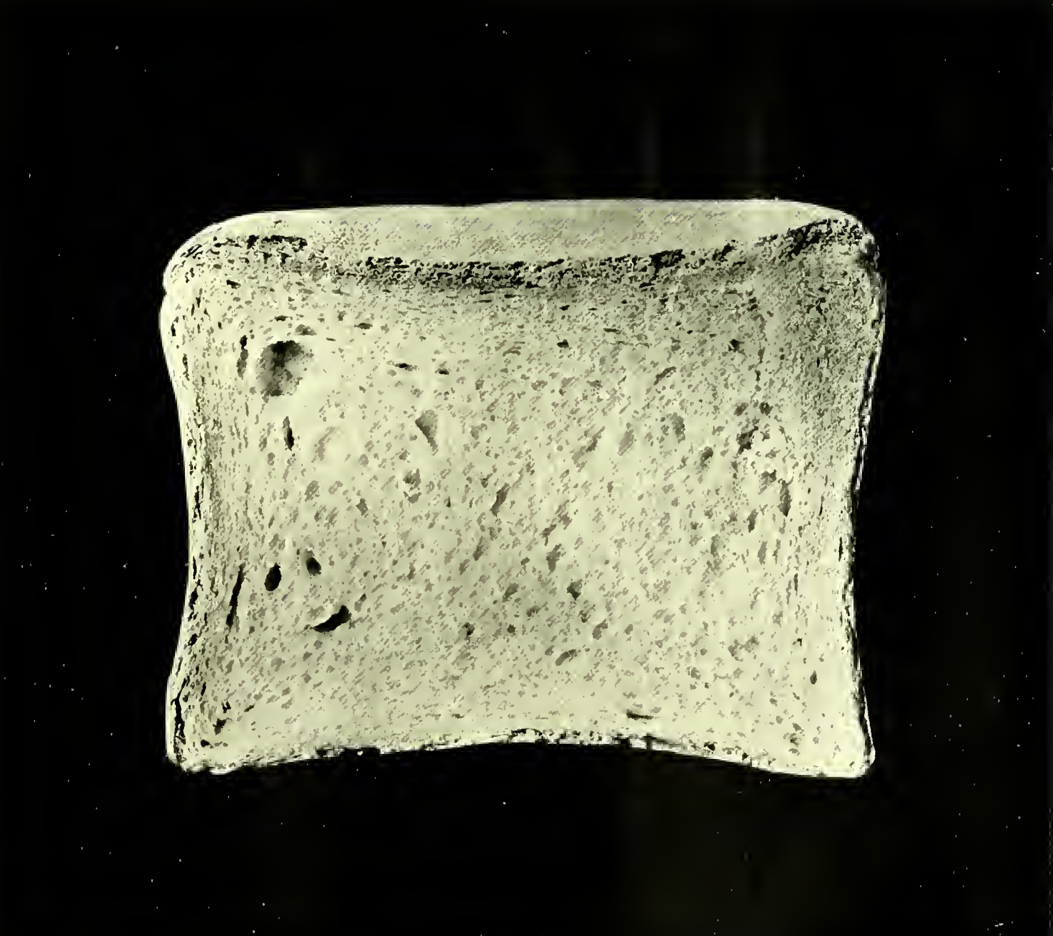
We are indebted to the well-known technical publisher, Mr William Hartmann, for permission to translate the following article, with additions of our own, on the Bread Trade of Berlin.

Berlin, the German Imperial city, and the capital of Prussia, had, at the end of 1900, about 1,900,000 inhabitants, for whom about 1800 bakers provided the most important food—bread. There are about ten bread factories in which bread is manufactured on a big scale, and which mostly produce one special kind, whereas all other proprietors of bakeries also bake more or less quantities of fancy bread and cakes. To this has to be added, of course, a considerable supply of country bread from the environs. Before we begin to speak of the kind of produce of the bakeries, it is advisable to give the following particulars of general conditions.

The work is divided in all the larger bakeries; the foreman arranges the dough and the yeast, with the exception of the bread and milk-bread dough. He weighs the salt and barm, heats the oven and bakes the goods. Bread and milk-bread dough are made by the kneader independent of help, whereas the third and fourth journeyman or the apprentices look after the other doughs. The working is generally carried on in the following way :—The foreman makes the yeast pieces ready, which are to be used by the third or fourth journeyman, and he weighs the salt and other ingredients, whereas the kneader makes the leaven and the milk-bread dough. During the rising of the yeast the wood at the back of the oven burns down. When beginning to make the doughs, the interior part of the oven is drawn out, and the oven so treated that it has time to cool down before the baking process begins. If the doughs are ready, the salt cakes are moulded first, whilst the other dough waits for half an hour to one hour, in order to effect a perfect rising. The men use this interval for their supper. The goods are afterwards made up in the same order as they are to be baked, that is, Blechschrippen, Semmel (small loaves), Schrippen (rolls), barm-breads, milk-bread, Knüppel (hard kind of rolls), and at last salt bars, English bread, etc. All cakes, Blechschrippen (better class of rolls), Hörnchen (little horns), etc., are placed on tins, whereas the white dough is placed on boards, covered with cloths, and has to stand in an airy room or in the yard before baking, to stiffen it. As soon as the cakes have risen enough, baking begins. Then come the salt cakes, and, if there is still sufficient heat in the oven, all the other goods. If the last goods are in the oven, the bread dough is made, and prepared for baking. Then follow more rolls, etc. The oven, which has been emptied by this time, is heated with wood.

A short time after the bread is put in the oven its position is changed, and if there is enough heat, one begins to bake the white bread on the vacant places. These second goods are generally the best. During the morning this process of baking is repeated generally once more, so that there are fresh goods put in three times daily. The interval is used in making up the other bread and the second lot of cakes. The remaining time is employed with the necessary clearing up, and in making preparations. In many bakeries they also make pastries. One can divide the Berlin baking into three parts—the bread loaf, white bread, and cakes. The bread, made of rye flour, mostly with a quantity of wheat flour, appears in different shapes in the trade. The most known shape is the long one, but there are also basket and other shapes. The usual price is 50 pfg. (6d.). For bigger families, etc., they also bake loaves at 75 pfg. (9d.), and 1 mark (1s.); for smaller requirements they often make loaves at 25 pfg. (3d.), and 15 pfg. (2d.), the last mostly round. The bread is made with leaven. A principal item in this baking process is that the so-called Vorteig (old sour, half sour, and full sour) should be in a good healthy state. The old sour is a remnant of the batch of the previous day. By mixing with 1½ to 2½ litres of water, one gets the old sour, and further, one gets the half and full sour, that form about half of the dough to be made. Considerable competition for the Berlin baker is experienced from the village bakeries in the environs of Berlin, which often causes so-called country bread to be sold by the town bakers.

Besides the loaf bread just spoken of, many bakeries also sell "black bread." This is made of bread dough, but with the addition of second quality rye flour. But one must not confuse this "black bread" with the black bread as made in Holstein, Mecklenburg, and Hanover, which consists of rye groats. The Berlin "black bread" is baked in a long shape, and is distinguished by a darker colour and sharper taste than the usual bread. The Berliner buys small rolls made of this black bread dough (four for 1¼d.), which, sprinkled over with caraway seeds, constitute breakfast rolls. To make barm breads, the dough is mixed with some sugar and currants, rounded, and after the proof, is pressed five to six times by hand or with a stamp. For "Schrippen," "Semmel," etc., one puts 5 lbs. to 5½ lbs. of dough; for barm breads, 2½ lbs. to 4 lbs. into the divider, which cuts out thirty. The price, with the exception of the salt cakes, is four pieces for 10 pfg. Salt cakes are made of mixed flour (rye and wheat) with water, salt, and yeast, in weight of 350 grams to 450 grams for 10 pfg. (six pieces for 1¼d.). To make



Section of Milk Loaf.
(ACTUAL SIZE.)

"Knüppel" and milk rolls, one uses only the best Hungarian wheat flour, pure milk, and some salt, and good yeast (no mixture with leaven). It is sold in four pieces for 10 pfg. (180 grams to 250 grams weight). In poorer districts they use cheaper wheaten flour, creamless milk, with the addition of butter and sugar. This translation, with additions, may not be so intelligible as we should like it to be, and would be omitted except that it contains at least some points of interest.

Writing of Canadian bread, Mr Wright, of Ontario, suggests the following ingredients to one pail (8 quarts):—"8 ozs. salt, 8 ozs. sugar (granulated), and 6 ozs. lard to be added at proper time. Here is a 10 pail batch illustration:—Twelve hours sponge, shop to stand at 80 degs. F. Sponge: 5 pails water, 70 degs. F., 5½ ozs. yeast (compressed), 1¾ bags of Manitoba patent flour, 75 degs. F. This amount of water and flour makes a good medium sponge. Where a machine is used to do the mixing this will be dropped, well and sufficiently worked in twelve hours, but bakers know flour is sometimes stronger than others, at least different brands are not always the same strength, and care must be taken that the sponge is not on the rise when mixed, but down in the centre about a couple of inches of drop; the second drop is generally sufficient work for this sponge. With a medium strong patent flour, the sponge being ready, 5 pails of water 80 degs. F., 5 lbs. of salt, 5 lbs. sugar, and 4 lbs. lard are now added, and the sponge and all broken up. Different kinds of bread (or shapes) can be made from this, such as Dutch, Vienna, snowflake, home-made, brown, whole wheat, etc. After the breaking-up sponge process, 1¾ bags flour, Manitoba patent, 80 degs. F., is added to full 10-pail sponge and water; a good medium dough will be the result of this mixture. This should prove in the trough one hour. When ready, throw out on tables and scale off at required weight, hand up on the table, then mould well into the pans, put away in prover till raised enough for the oven; this will require about one hour, and should get a medium proof. It is now ready for baking. This leads us to the oven. It should be heated to about 400 degs. Ovens differ in the length of time required to bring them to the necessary heat. The average will require about one hour to draw, and one and a half hours lay down. In this way a good oven has an even heat and is solid. Before the dough is taken from the trough, the damper is drawn and the right amount of coal put on at once. When bread is handed up on the bench, the oven is shut off. Allowing the time it takes to pan and the proving of the bread for the oven to lay down, in the baking process if oven is filled, the temperature will go down to 350 degs. The time for baking varies according to the different weight or size of the loaf, 2 lbs. bread taking one hour in nice solid oven, 1½ lbs. bread not more that three-quarters of an hour."

Although many other methods and many other details concerning them could be given, we think this chapter is already sufficiently long, and important to have, by itself, fully justified the publication of this book. The tables both in preparation and in the printing have been exceedingly costly, and will be found to contain the information for answering the great majority of questions that are being continually asked by bakers in the ordinary course of their business. They give the results of an exceedingly large number of practical experiments and operations, saving therefore much time and money when seeking progress, and give much food for further ideas; we must therefore be pardoned for saying that they cannot fail to be of immense importance, returning value strictly in accordance with the time and intelligence spent on their close examination and studying.

HOME-MADE BREAD

HOME baking, although at one time more universal, seems to linger to its greatest extent, as far as this country is concerned, in the four or five most northern counties. We studied it closely when visiting Leeds and Newcastle. In Newcastle and district there is a population of about 300,000, and yet, with the exception of the Co-operative Society, there is only, as far as we could ascertain, about one leading firm of bakers to every 30,000 people; whereas in London there are nearly 4000 master bakers (about 13,000 journeymen), or one firm to every 4000 of the population (one of them doing nearly 3000 sacks per week), and many instances could be given where the proportion is higher. We have noticed that where home baking abounds, bakers' bread, with exceptions of course, seems far less appetising in appearance. Bakers say they have to make it like that of the home baker; nevertheless, where better looking bread is made by bakers, there is less of it made by the housewife, which would seem paradoxical if the former assertion be true. There might be dislike by the housewife to sponginess and lightness after being accustomed to her own more filling product, or suspicion of whiteness that might be thought to be artificial, but we cannot see any reason for the roughly finished exterior, the daubs of dry flour, and the sickly paleness, absence of bloom, and half-baked and uninviting character of nearly all we saw in one large town. Much of the conservatism of those who make their own seems to us to be due to ignorance of what it really costs them, and to prejudice against the presumed nefarious tricks and uncleanly ways of certain bakers to which some sections of the Press are so constantly referring and grossly exaggerating.

It seems, then, that much good could be done if periodical popular lectures were given concerning modern methods of bread-making, pointing out the difference between what was and what is, and that the three halfpence for the cost of yeast per stone of flour, which seems to be all that the housewife reckons, is by no means the total cost of baking at home. Explanations concerning the economy of producing bread on a larger scale would certainly tell against those women who bake for some dozen of their neighbours, as is customary in some places.

Then, the man with a corner shop, with his bakery on a level at the rear, could, without the expense of formerly, equip a neat machine bakery, and, instead of inviting periodical visits, which usually fall flat, and are also forgotten by the public (unless a special visitor's day is set apart and special demonstrations or lectures given), he could put plate glass all down the side, the same as he would to his shop, and, having everything in good order, there would be no objection to being on view from the street always. There would usually be onlookers, as there always are at even less interesting operations, and those that only looked once would feel that constant publicity had dispelled their former prejudice, and the advertisement would be such as to well repay the structural alterations and the white jackets for the men. The men would not be distracted by the visitors who were only in sight and not in contact; they would soon get used to it, and take more pride in their work, and the quickness with which they could do it, never knowing when friends or superiors were looking. The public could not fail to be interested, and try goods out of curiosity, if nothing else, as they do at trade exhibitions, and if they did not like the sort, they might be more disposed to try some other kind they had seen made. Such a constant view would have a far greater effect than the occasional invite to the well-dressed lady who had bought something in the shop, and also a more beneficial effect than the costly and injurious system of house-to-house free samples.

In the North coals for home use are cheaper, but home baking is far more general in America than here, and there coals are scarce and dear enough at the present moment. In the North the domestic ovens are different to that of the South; they are mostly open ranges, with the oven, at the side, raised so that its bottom is on a level with the top of the fire, enabling the flames to draw under the bottom, up the far side, and over the top, instead of the oven being lower and side by side with the fireplace, as here. The home method we found mostly adopted was a batter sponge, sugar and, occasionally, milk being added—stand half hour, then make dough and stand one or one and a half hours; scale direct into tins, being about three hours to the oven from the start. It seems that if bakers supplied a well-finished loaf from a lot of yeast and off-hand dough of about two hours in trough, whereby it was sweet and close, imitating the inside of a home-made loaf and not the outside, instead of usually now the reverse, and well-pushing, as indicated, to remove prejudice that they must gain trade always, instead of just at the time when the working class of women are busy at work and unable to bake. Even in the districts where every house has a suitable bread-baking oven, and, moreover, every woman taught to bake, the hot weather or sufficiency of employment often decreases the home baking, and then is the bakers' chance to supply something extra good, whereby the housewife will not require to resume making her own. In some cases, however, although made at home, the bread is taken to the baker to be baked. We have found many correspondents gradually gaining ground, especially where they supply a good variety of sorts as a change, particularly of the brown and fancy class, and by attention show the housewife how very convenient it is to buy instead of making.

We have said that home baking is much more general in America than here, but it is there also gradually becoming less in the large towns. In New York there is already comparatively little done now, and it is becoming less in Philadelphia, and in Minneapolis some excellent bakeries have been built, but in Baltimore the home baking is still large, and bakers' bread, in spite of cutting prices in some districts, is not supplied so cheaply as here. The following process, which was prepared for the Washburn-Crosby Co., will be useful to reproduce, as supplementary to other domestic methods already given here and in the tables.

To one quart of lukewarm liquor (composed of equal portions of water and sweet milk, or water alone) add two half-ounce cakes (1 oz.) of compressed yeast and stir until completely dissolved, then add one teaspoonful of salt and three table-spoonfuls of sugar. When salt and sugar are thoroughly dissolved, stir in well-sifted flour with a wooden spoon until a dough is formed sufficiently stiff to be turned from the mixing bowl to the moulding board in a mass. The quantity of flour used to above liquor should be about three quarts; to this flour may be added with excellent results, about two table-spoonfuls of lard if shortening is desired. Knead this dough, adding, if necessary, a little flour, from time to time, until it becomes smooth and elastic, and ceases to stick to the fingers or moulding board. Then put it in a well-greased earthen bowl, brush lightly with melted butter or dripping, cover with a bread towel or blanket and set to rise in a warm place for two hours, or until light. As soon as light, knead well and again place in earthen bowl, covering as before, and set for another rising of an hour, or until light. As soon as light, form gently into loaves or rolls, place in greased bread or roll pans, brush with melted butter or dripping, cover again with the towel or blanket, and let stand for one hour and a half ($1\frac{1}{2}$), and then bake.

The following points are also desirable to remember:—(1) Dough, when light enough to bake, should be nearly double the size it was when first set to rise, and should be as light that when lifted in the pan the sense of weight will be scarcely perceptible.

(2) Bread should be put to bake as soon as it is light, and the oven, at the commencement of baking, should be at a temperature of 375 degs. by the thermometer, or hot enough to brown flour in two minutes without burning it.

(3) The time of rising, of course, depends upon the temperature of the place where kept; 75 degs. is the best.

(4) During the rising see that the dough does not become chilled. The temperature must be kept uniform.

(5) In using compressed yeast see that it is fresh, and not too soft.

BUCKINGHAMSHIRE AND OXFORDSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
Made 60 quarterns.	$1\frac{1}{2}$lb., and sugar 8oz. (10 minutes' start).	Straight dough 8 a.m., cut back 9.30, throw out 10, handed up twice, in oven 11.30, baked 50 minutes. Dough, when made, 82°. 2lb. salt (December).	Process reads well, but loaf very bound and dry. Make dough slacker and give more time after moulding before setting. Unripe. Pinched. (1)
70lb. ($\frac{1}{4}$ sack) Exhibition flour.	12oz., and malt extract 1oz.	Straight dough, start to finish 4 hours, cut back twice. Water 110°. 1lb. salt (August).	Three loaves received at same time from same quantity and grade of flour and same particulars of process from 3 different men, were very widely different. (2)
Batch of 130 loaves.	6oz.. and sugar $1\frac{1}{2}$lb.	Straight dough 9 p.m., water 84°, knocked down 8 a.m., again, 9.30, out 10.30, in oven 11.30 for 1 hour, oven shut down at 8.30. $2\frac{1}{4}$lb. salt (Sept.).	Too much sugar. Too long in trough, and not enough out. Better than usual from such a process. Not least good for prize. (3)
125lb. flour (90lb. White Tie at 24s., and rest American pat.), bread 10d. per gallon (2 quarterns).	12oz., and sugar 8oz. (No. 1 London Households, 22s. 6d.).	Straight dough commenced making 4.40 a.m., finished at 5.5, then being 88°, flour 66°, water $6\frac{1}{2}$ gals. at 110°, cut back 5.45 and 6.45, taking 15 minutes first time and 10 minutes the second, handed up twice, in oven 9.30 a.m. for $\frac{3}{4}$ hour. 26oz. salt (May).	Good ordinary cottage except for one large hole caused by lump of skin being inside, and also streaks from surfaces of pieces being too much exposed. Barely 70 marks out of 100. (4)
Batch 4 bushels, local straight grade at 24s., and fines 22s. 6d., bread 5d.	5oz., and malt extract 1lb.	Straight dough 8 p.m., cut back 6.am., thrown out 7, in oven 8.15 a.m. for $\frac{3}{4}$ hour. Heat of dough, 82°. (No. 1 London Households, cash ex mill 21s. 9d.) 14oz. salt (July).	Very ordinary loaf. Eleven hours in trough at 82° is too much with country flour and malt extract. Omit the latter, and increase salt. As usual, rushed into oven too soon after moulding. (5)
Half sack.	1lb. (with 15 minutes' start), and sugar 1lb.	Straight dough, flour 72°, water 106°, trough 4 hours, baked 50 minutes. Flour to loaf 6 hours. $1\frac{3}{4}$lb. salt.	Good. Less in trough, more in tin. (6)
1 sack.	10oz., and 1lb. extract.	Ferment with yeast and extract and 3lb. flour, with water 90°. Allow drop. Dough $4\frac{1}{2}$ hours, cut back, another half hour. 3lb. salt.	Good. Two men ought to make a sack dough in 20 minutes, scale and hand up 20 minutes. moulding 20 minutes, and setting 15 minutes. (7)
28lb	4oz., and sugar 1oz.	Straight dough, water 90°, trough 4 hours. 5 oz. salt.	A good small batch. (8)
28lb.	$3\frac{1}{2}$oz., and meat extract 3oz.	Straight dough with $1\frac{1}{2}$ gallons, 82° when made. Trough $1\frac{1}{4}$ hours, tin 1 hour. Start to oven $3\frac{1}{2}$ hours. 5oz. salt.	Another (9)
4lb	1oz	Straight dough, 2lb. water 90°, trough 6 hours, salt $\frac{3}{4}$oz.	A test loaf. (10)

CAMBRIDGESHIRE, HUNTINGDONSHIRE, AND BEDFORDSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
18 stone country, 2 stone American.	12oz. to sack.	Sponge, with half liquor, cold, 6.30 p.m., dough 4 a.m. at 70°, in oven 6 a.m. 3lb. salt (September).	Merely average. Over ripe. Too long in trough, not enough in loaf stage. (1)
1 sack, first American pat. spring.	12oz., and malt extract 8oz.	Straight dough 10 p.m., in oven 6.30 a.m., water 105°F., and flour 71. 3lb. salt (November).	Successful daily loaf, 80 marks. Better finished than usual. Flour not good enough for exhibition. (2)
280lb.	1lb.	Straight dough, in trough 6 hours (with cut back) to be 80° when finished making Scale, hand up, cover over, and prove, hand up again, cover over and prove, top and bash when moulding, prove in boxes, bake 40 to 45 minutes in hot oven. Total 8 hours to setting. $3\frac{1}{2}$lb. salt.	Recommended to correspondent and found successful. With 4 hours in trough, have $1\frac{1}{2}$lb. yeast (start it for 15 minutes in extremes of weather). Dough 80° (and in winter 85°) when made. Average flour (3)
1 sack local seconds.	9oz., and malt extract 8oz.	Sponge 11 hours. dough 45 minutes. 3lb salt.	Fair average tin. Oven too cold. Less in sponge and longer in dough wanted. (4)
20 stones flour.	1lb.	Sponge 9 p.m., broken 5.30 a.m., thrown out 6.30, in oven 8.30 a.m. Sponge water 90° and dough 100°. $2\frac{1}{2}$lb. salt (October).	Very poor indeed. Exhausted, much over-fermented, flavour gone, no bloom. Dry. Oven said to be 300° F.—impossible. (5)
1 sack.	12oz.	Half sponge 10 hours, cold water 18 gallons. 3lb. salt (July).	Fair loaf, but coarse in texture. Apparently mistake in water, although that quantity usual elsewhere. (6)
$\frac{3}{4}$ households, $\frac{1}{4}$ first spring pats.	8oz., and fruit $3\frac{1}{2}$lb.	Ferment 4 p.m., $1\frac{1}{2}$ pails liquor, 96°, dough 10 p.m., making liquor up to 4 pails at 78°, adding 2oz. more yeast, cut back 4 a.m., thrown out 5.30, handed up twice, in oven 7.30 a.m. for $\frac{3}{4}$ hour. $2\frac{1}{4}$lb. salt (October).	Shape all right, but not nice to eat. Twangy. Certainly more worked by yeast than good. Smells. (7)
1 sack.	$1\frac{1}{2}$lb. (with start), and sugar 12oz.	Straight dough, 4 hours in trough, 1 cut back, 16 gallons water (dough 80° when made), 5 hours to oven. $3\frac{3}{4}$lb. salt.	A good tin loaf. (8)
1 sack.	$1\frac{1}{2}$lb., and sugar 1lb.	Straight dough, $3\frac{1}{2}$ hours trough, 79° when made. $3\frac{1}{2}$lb. salt.	Good cottage. (9)
1 sack.	$1\frac{1}{2}$lb., and malt extract 1lb.	Straight dough, 3 hours trough, at 86°–90° when made. $3\frac{1}{2}$lb. salt.	Recommended by Stormont. (10)
1 sack.	1lb. brewers' compressed, and potatoes 10lb.	Ferment with 10lb. soft flour and the fruit and 3 gallons water at 80°, ready 2 hours, sponge at same for 7 hours, dough $1\frac{1}{2}$ hours. 3lb. salt	Old-fashioned process, but good loaf. (11)
1 sack.	$1\frac{1}{2}$lb. (4oz. less in summer).	Straight dough, 80° when made, 6 hours out of oven from start (4 hours trough), machine made and machine scaled. 3lb. salt.	A good cottage. (12)

Cambridgeshire, Huntingdonshire and Bedfordshire Methods—Continued.

Flour	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
2 bushels.	2lb. (1lb. to bushel).	First, when answering whistle, put yeast in about gallon water and $\frac{1}{2}$lb. sugar, prepare rest water at 130°, add to flour, then add yeast, throw out directly made and keep straight on.	Bread placed in shop or vehicle within 2 hours of receiving the order. Very nice to eat—like cake—but small, like "home-made." (13)

CHESHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
280lb. English and Swedish pat.	$1\frac{3}{4}$lb., and 10oz. malt extract.	Straight off dough, water 110° (April), cut back at $1\frac{1}{4}$, stand another hour, baked 45 minutes, whole process $3\frac{3}{4}$ hours. $2\frac{3}{4}$lb. salt.	An interesting and good series from same firm. The tin (No. 3) is the best, and very good, worth 83 marks, would be better texture if slacker. The crumby (No. 2) is worth 74 marks, being deficient in pile and volume. The cottage is worth 75, and is also small. (1, 2, and 3)
Same flour as No. 1.	$1\frac{1}{2}$lb., same extract.	Straight dough $1\frac{1}{4}$ hours, cut back, another $1\frac{1}{4}$ hours, baked 1 hour. Whole process, $4\frac{3}{4}$ to 5 hours. $2\frac{3}{4}$lb. salt.	
Same.	$1\frac{1}{4}$lb., same extract.	Straight dough, liquor 98°, 3 hours, cut back, then $1\frac{1}{2}$ hours, baked 55 minutes. Whole process, 6 hours. 3lb. salt.	
280lb. best Liverpool pat.	2lb., and 12oz. malt extract.	Sponge 1 hour at 90°, 5 hours start to finish $3\frac{1}{2}$lb. salt.	Excellent everyday loaf. Crust little red. Good flour, good process. Little slacker and longer in tin. (4)
280lb.	$1\frac{3}{4}$lb.	Straight dough 6 a.m., 3 hours, in oven 10.30, water 100° (October), bakehouse 80°. 3lb. salt.	Two good commercial loaves. Tin better than the plain. Press down less and ram fist in less. (5)
1 sack, half Liverpool 2nd pat. and half Kansas.	$1\frac{1}{2}$lb., and little malt extract.	Straight dough, water 100°, $3\frac{1}{4}$ hours start to finish, baked 45 minutes. 3lb. salt.	Much underworked tin. Heavy, holey, sweet. Red crust. Checked. (6)
240lb. local.	1lb., and 8oz. sugar.	Straight dough, 5 hours start to finish, water 95°, flour and bakehouse 75°. 3lb. salt.	Wholesome tin loaf of good flavour and colour. Holes because of small tin and insufficient proof. (7)
5 bushel bread, fines flour.	$1\frac{1}{4}$lb., and 2lb. sugar, and 10lb. scalded cornflour.	Straight dough, 11 hours start to finish, baked 45 minutes. Dough 64°, bakehouse 80° (June).	Rather poor. Too much yeast food. (8)
1 sack British pats.	2lb., and malt extract 1lb.	Straight dough, water 100°, in oven 4 hours from start. 3lb. salt (March).	Excellent—94 marks. Tin could do with little warmer water. (9)
140lb. British pats.	8oz., and 2oz. sugar and 3oz. malt extract.	Sponged 11 p.m., stand 4 hours, out of oven in $7\frac{1}{2}$ hours (March). 8oz. salt in sponge and 1lb. in dough.	Good tin, 86 marks. Barely ripe enough. Short sponge does not require one-third of total salt. (10)

DERBYSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 stone best Liverpool pat. and 1 stone local pat.	4oz., and 1oz. malt extract.	Straight off dough at 100°, 1 hour, knocked down, another hour, knocked down again, another half hour, and thrown out. 4oz. salt.	80 marks to cottage and 76 to tin, off same dough. Not good enough for the flour. Badly made. (1)
1 sack.	2lb.	Straight dough, 16 gallons to sack, at 7; on boards 9, in oven 9.40. Yielded 25 stone (200 half-quarterns, at 2lb. 3oz.) at $4\frac{1}{2}$d. per quartern. $3\frac{1}{2}$lb. salt (March).	Fair, medium tin. Coarse, uneven texture; badly mixed. Heavy in hand, although porous and well risen inside. Crumbly. Can easily detect scalded matter. (2)
168lb. local pat., price $5\frac{1}{2}$d.	36oz., and sugar 12oz.	Straight dough 7 a.m., thrown out 8.15, in oven 9.15 a.m. Half-quarterns baked $\frac{3}{4}$ hour and quarterns 1 hour. Water 100°. (No. 1 London Households in "Walker," 23s. 9d.). 48oz. salt (January).	Good ordinary tin loaf; underproved and nice eating, but salt. A cottage from same dough also shows under-working at all stages. (3)
1 sack ($\frac{1}{3}$ Hungarian, $\frac{2}{3}$ English pats.).	1lb.	Straight dough, 16 gallons water 100°, made 8.30 p.m., scaled 11.30, in oven 12.30. (April.)	Very good tin loaf. Command trade anywhere. Not large, and not, therefore, carrying the water as well as some. (4)
$1\frac{1}{2}$ packs (240lbs.) or nearly $1\frac{1}{3}$ sacks of Liverpool pats.	$3\frac{1}{4}$lb., and sugar 14oz., and malt extract 6oz.	Straight dough, flour 70°, bakehouse 80°, water 88°, made 6.15 a.m., cut back 7.15, again 8.15, thrown out 8.30, stand half hour, scaled 9.15, tins turned 10, in oven 10.25 a.m. for 35 minutes. $3\frac{3}{4}$lb. salt (July).	Excellent tin loaf, worth 93 marks out of 100. Only fault is that tin does not properly hold it, therefore little pulled over by heat of oven. Crust colour is rather high, but the best brand of flour from same mill would have stood the added sugar without showing it so much. (5)
1 sack British pat., 23s. 6d. (No. 1 London Household, 21s. 9d.).	$2\frac{1}{4}$lb. to sack.	Straight dough, got into oven $3\frac{3}{4}$ hours from start, baked half hour. $4\frac{1}{2}$lb. salt to sack.	Excellent tin. Just a little too long in tin for its speed. Top quite flat and cracking. Little less change better. (6)
1 sack.	2lb., and malt extract 12oz.	Straight dough, water 95° Dough to oven $4\frac{1}{2}$ hours. Baked 45 minutes at 450°. $3\frac{1}{4}$lb. salt.	Machine made, good daily cottage, but more proof better. (7)

DEVONSHIRE AND CORNWALL METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
Country supers.	6oz.	Bakehouse 75°, water 75° (June). Sponge, 10 hours. Dough, 1 hour. Baked 50 minutes. Salt, 10oz. in sponge and $2\frac{1}{4}$lb. in dough.	Good all-round ordinary country tin loaf. Wants little more proof in larger tin. (1)
280lb. all English supers.	12oz. yeast, 6lb. potatoes.	Ferment 80°, dough 90° (April). Ferment at night, dough in morning, rise $2\frac{1}{4}$ hours, cut back, and rise another $1\frac{1}{2}$ hours. 2lb. 10oz. salt.	Numerous holes. Dough badly made. Poor loaf. Flavour best point. Texture and volume low. Total, 56 points. (2)

Devonshire and Cornwall Methods.—Continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack.	2lb. and 12oz. malt extract.	Water 112° F. (April). Dough straight off. In oven in 4 hours from start. Baked 1 hour. 3lb. salt.	A heavy tin loaf, not sufficiently developed. More time in tin. Excessive bloom. Total, 69 marks out of 100. (3)
1 sack all English supers (local).	$1\frac{1}{2}$lb. distillers'.	90° (March). Oven 400°. Dough straight off. Cut back in $1\frac{1}{2}$ hours, 1 hour afterwards. Baked 55 minutes. Start to finish $5\frac{1}{2}$ hours. 3lb. salt.	Good cottage and tin. Worth 88 marks. Changing from ferment, sponge, and dough with brewers' was a success. Good flavour. (4)
Same as No. 4.	$2\frac{1}{2}$lb. liquid brewers'.	Ferment 75°, sponge 75°, dough 70°, bakehouse 70° (October). Ferment with 10lb. fruit and $1\frac{1}{2}$lb. scalded flour 5 hours. Sponge, 9 hours. Dough, $1\frac{1}{2}$ hours. 3lb. salt.	This is what No. 4 changed from after long letter. (5)
Same as Nos. 4 and 5.	$1\frac{1}{2}$lb. distillers'.	80° when finished making (October). Straight off dough, $4\frac{1}{2}$ hours' start to oven. 3lb. salt.	From same man exactly five years afterwards. Cottage is under-ripe and under-proved. (6)
1 sack.	2lb.	Ferment (so-called) at 94° for $\frac{3}{4}$ hour. Dough, 1 hour. Half hour in tins before finishing, then another half hour. Baked 45 minutes.	A home-made loaf, small and close, but delicious. Calls sponges antiquated. (7)
20lb. ($\frac{1}{14}$ of sack).	3oz., and 2oz. malt.	Water 120° (October). Dough, 2 hours. Cut back, and give another hour. Baked 50 minutes. 4oz. salt.	Good ordinary loaf. No good for exhibition. (8)
84 quarterns bread, half local supers, half Amer. patents.	$1\frac{1}{2}$lb. yeast, 1lb. food, 8oz. sugar.	Straight dough (15 minutes start) at 7.15. In oven 10.30. $3\frac{1}{2}$lb. salt.	Fair ordinary saleable tin loaf; but cottage from same not so good. Wants more time and more finish. (9)
100 quarterns bread.	10oz., and 8oz. sugar.	Water 90° (October). Sponge, 8 p.m. to 6.30 a.m. Dough, 45 minutes. In oven 9.45. Baked 50 minutes. $2\frac{1}{2}$lb. salt.	Ordinary good daily cottage. Short of salt for the time. (10)
Same as No. 10.	Ditto.	Same oven, 400°. Sponge same. Dough in oven 9.30. 3lb. salt.	Loaf not so good as No. 10, worth 69 points only. Wants less in sponge and more after dough-making, and warmer oven. (11)
1 sack all British made.	$1\frac{1}{2}$lb.	Water 90°, flour 68°, bakehouse 70° (June). Dough 6 a.m., two cuts back, lifted 8.30, in oven 9.45, baked 55 minutes. $3\frac{1}{2}$lb. salt.	Good; but a tin loaf could well be from slacker dough and more baked. (12)
	4oz.	$4\frac{1}{2}$ gallons in sponge at 65°, 5 gallons in dough at 60°. Sponge 6 p.m. to 3.45 p.m., in oven 8.50 (November). $1\frac{3}{4}$lb. salt.	Not to be imitated. (13)
1 sack.	5oz.	Water 100°, bakehouse 58° (December). Dough straight up at 9 p.m., in oven 9 a.m. 3lb. salt.	Too much time out of tin and too little in tin. Holes from non-recovery from moulding. Poor. Only about 60 marks. (14)

DEVONSHIRE AND CORNWALL METHODS—Continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
$1\frac{1}{3}$ sacks, all English made.	$2\frac{1}{2}$lb.	Water 86°, bakehouse 76° (March), oven 465°. Doughed 5.30 a.m., two cuts back, thrown out 11.0, in oven 12.25, drawn 1.20. 4lb. 6oz. salt.	Time too much for the amount of yeast. Too tight, and baked too long for tin. (15)
70lb. ($\frac{1}{4}$ sack) 3 parts local supers and 1 Amer. patents.	10oz. yeast, 4oz. sugar.	Straight dough 6.40, in oven 11, baked 50 minutes. 12oz. salt.	Good bread. The loaf in larger tin is better than smaller—same dough. Wants less in trough and more after throwing out, and hotter oven. Has burst-up ends. (16)
280lbs. country patents.	$1\frac{1}{2}$lbs., and 8oz. sugar.	(Nov.) Ferment for half hour at 96°, dough 1 hour, cut back, in oven $2\frac{1}{2}$ hours after being made.	Beautiful tin—94 points. Fully worked, cooler ferment better. (17)
280lb. local straights and supers.	$1\frac{1}{2}$lb.	Water 95°, oven 440° (October). Straight dough 2 hours, cut back, and another hour. Baked 1 hour. 3lb salt.	Splendid tin loaf—91 marks. Equally divided. (18)

DORSET METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
100 quarterns bread, $\frac{2}{3}$ British Fines and $\frac{1}{3}$ Minn. patents.	9oz. (bread 5d., No. 1 households, in "Walker's Notes," 23s.).	Water 83°, flour 58°, oven 420° (December). Straight dough 7 p.m., cut back 6 a.m., thrown out 6.45, hand up, prove 30 minutes, mould, prove 15 minutes, bake 55 minutes. $3\frac{1}{2}$lb. salt.	Gets complaints dryness. Both good commercial loaves. No. 2 the better. No. 1 wants 10° hotter in finished dough, slacker, and less time trough (3 hours). No. 2 hotter with same time, or else more time. Both want more recovering after moulding, and also less time in hotter oven—quicker baking. (1 and 2)
Same as No. 1.	2lb.	Water 110°, flour 55° (December). Oven 420°, steam pipe. Straight dough 7 a.m., out of trough 10.15 (2 cuts back), hand up, prove 20 minutes, mould, prove 10 minutes. $3\frac{1}{4}$lb. salt.	
$\frac{2}{3}$ Fines, $\frac{1}{3}$ supers, made 23 loaves.	8oz. (bread $4\frac{1}{2}$d., No. 1 households, 24s.).	Water 110° (July). Straight off 9 p.m., cut back 10.30 a.m., in oven 11.30 a.m. 8oz. salt.	Good average tin loaf and of good flavour, but crumbles. Give less in trough, make slacker dough, and give more labour. (3)
	4oz., and 1oz. malt extract.	$1\frac{1}{2}$ gallons water at 110° (October). Straight off and in oven $2\frac{1}{2}$ hours from start. 3oz. salt.	Excellent loaf, but too free and ramping for big batch with ordinary help. Too much ripened. Top crust lifted as balloon, because no bash hole. (4)
70 to 80 quarterns bread.	12oz., 2lb. granulated sugar.	Straight dough for 8 hours, cottage. $2\frac{1}{2}$lb. salt.	Both poor, cottage worth 56 points and tin 53, colour and flavour very poor. Not baked enough, and set too closely. Too much sugar. Tin too tight. (5)
Same as No. 5.	8oz., 8oz. sugar.	Sponge, dough 1 hour, tin. $2\frac{1}{4}$lb. salt.	

DORSET METHODS—Continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack ($\frac{3}{5}$ Fines).	18oz., and malt flour 2lb.	(July.) Straight dough 6.30 a.m., cut back 7.30, thrown out 9.30, in oven 10.30 a.m. for 1 hour. 3lb. salt.	Ordinary wholesome loaf for flour. Fermentation good, and also manufacture, except for holes by bashing. (6)
1 sack.	$\frac{3}{4}$lb., and sugar 8oz.	Straight dough, 15 gallons, 80° when made, 10 hours, including cut back. 3lb. salt.	Average daily loaf. (7)

ESSEX METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
Equal parts Amer. supers, town whites, country whites and households.	1lb. to 7 bushels.	Dough straight off at 3.30 a.m., water 96°, bakehouse 80°, thrown out 7.15 a.m., all drawn 9.30, baked 40 minutes; total, 6 hours. 3lb. salt (Oct.).	Wants less time trough, more after moulding. Cottage 74 marks, shape and volume most, texture least. (1)
1 sack town whites and extras, country whites, and Amer. patents.	1lb.	Straight off 5 hours, cut back, then another hour, in oven $1\frac{1}{2}$ hours after throwing out. Dough 80°, bakehouse 65°. 3lb. salt (January).	Poor loaves for flour. Process good, excepting insufficient proof. Bound and dry. Tight and too long in oven. (2)
1 sack local 23s. (No. 1 London households, 21s. 6d.), price 5d. per quartern.	2lb., and sugar 8oz.	Straight dough 5 hours from start to oven, when made 78°, water $14\frac{1}{2}$ gallons. Salt (February).	Good and healthy cottage. Dough a little too cold for the cold weather then ruling. A tin loaf from precisely the same process on another day was much riper. (3)
70lb. ($\frac{1}{4}$ sack).	10oz., and 2oz. sugar and 2oz. malt extract.	Straight dough at 6, was then 82°, cut back 7, 8, and 9, out of trough 9.30, and then was 82°, moulded and bashed 10.15, in oven 11 for $\frac{3}{4}$ hour, 13 qts. water, flour 70°. 12oz. salt (September).	Good cottage. Great improvement everywhere on your last, yet same flour. (4)
9 bushels.	3lb., and half pint malt extract.	Straight dough at 5.30, cut back 7.30, out of trough 9.30, in oven 11.30, flour 60°, 26 gallons water 102°, dough when finished making 82°, when thrown out 80°, bakehouse 78°. 5lb. salt. (Oct.).	Average cottage. Oven too rash, unless loaves protected by steam. (5)
1 sack, $\frac{1}{2}$ country households, $\frac{1}{4}$ country pats., $\frac{1}{4}$ Amer. pats.	12oz.	Straight dough 8.30 p.m., in oven 8.15 a.m. 3lb. salt (October).	Average country cottage, badly manipulated after throwing out. (6)
$2\frac{1}{2}$ bushels.	2lb., and malt extract 2oz.	Straight dough 1.15 p.m., out of trough 2 p.m., out of oven 3.55, baked 40 minutes, being $2\frac{3}{4}$ hours from start. Water 110°. Bakehouse 75°. $1\frac{1}{2}$lb. salt (March).	Passable commercial loaf, 82 points. Too bound, small and close. Undeveloped. Not time enough. Exhibition flour. (7)

Essex Methods.—Continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
Batch 70 quarterns, 28lb. Vienna and rest Amer. pats. and country households.	12oz., and 3oz. diastase (malt extract).	Straight dough, water 86°, 10.15 p.m., thrown out 6.30 a.m., baked by 9.30. Price $5\frac{1}{2}$d., No. 1 London households in "Walker's Notes," 24s. 2lb. salt (October).	Constituents changed about as should be, but not well finished. System of blending is incorrect. (8)
35lb. ($\frac{1}{8}$ sack) Exhibition.	6oz., and sugar 2oz.	Straight dough, 2 gallons water at 85°, flour 68°, bakehouse 74°, finished 80°. Dough to oven 7 hours, 2 cuts back. In oven $1\frac{1}{4}$ hours after tinning. Baked 50 minutes (500° to 430°). Handed up twice. 8oz. salt.	Good Exhibition tin, but shade overproved. 95 marks. (9)

GLOUCESTERSHIRE AND HEREFORDSHIRE METHODS (Bristol, &c.).

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
$\frac{1}{3}$ sack, local supers, and lower grade, and Amer. 1st pat.	12oz. brewers', $1\frac{1}{2}$oz. distillers', 4oz. malt extract.	Sponge with $\frac{1}{3}$ liquor at 75° for 12 hours. Dough water 110°, and in oven $2\frac{1}{2}$ hours after making. Flour 75° (over oven), February. Salt, 4oz. in sponge and 10 after.	Good in all points except texture and holes. Unnecessarily tedious process for small batch; 82 marks out of 100. (1)
$\frac{1}{2}$ sack.	14oz.	Off-hand dough with $7\frac{1}{2}$ gallons at 105°–110°, cut back 2 hours, another hour, out of oven within 6 hours. 20oz. salt.	Will be as good as above with less trouble. (2)
1 sack, cost 33s. 6d., bread 6d., Eng. milled.	$1\frac{3}{4}$lb., and 12oz. malt extract.	Dough straight off, water 113°, oven door closed 4 hours from doughing (April). 3lb. salt.	From same man, and flour mixture as No. 1 above, but better loaf. Excellent cottage, worth 92 marks. (3)
Flour 21s. (No. 1 households in Walker, 21s. 6d.), yield 80 quarterns.	"Barm 2lb. and 1oz. yeast" (probably liquid brewers' by weight).	Sponge 7 p.m., $6\frac{1}{2}$ gallons at 90°, flour 53°, bakehouse 64°, dough 7 a.m., with $7\frac{1}{2}$ gallons at 94°, finished mixing at 7.40 a.m., thrown out 9 a.m., oven closed 11 a.m., baked 1 hour. $3\frac{1}{4}$lb. salt (8oz. in sponge).	Good ordinary country cottage; nice to eat, but poorly finished. Have smaller head and hotter oven, and less time there. Wants more bloom. Head compresses bottom too much. (4)
$\frac{1}{2}$ sack.	5oz.	10 hours sponge, $3\frac{1}{2}$ gallons, dough $3\frac{1}{2}$ gallons, at 6.30 (finished), thrown out 7.15, in oven 9.30, and baked 55 minutes. $1\frac{1}{2}$lb. salt (April).	Poor material, poorly handled. Too much fermented. (5)
28lb. Exhibition flour ($\frac{1}{10}$ sack).	$3\frac{1}{2}$oz., and malt extract 3oz.	Straight dough 82° (when made) 10 a.m., thrown out 11.20, moulded, lie 20 minutes, moulded again, prove $\frac{1}{4}$ hour, tinned, proved 1 hour. Dough making to oven $3\frac{1}{2}$ hours, $14\frac{1}{2}$lb., water at 150° (?). 5oz. salt (August).	Excellent tin, 92 points. Docking here gives a hole just under crust. Wants bigger tin. (6)

GLOUCESTERSHIRE AND HEREFORDSHIRE METHODS (BRISTOL, &c.).—Continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
80lb. Exhibition flour.	10oz., and sugar 2oz.	Straight dough 4 hours to oven closing, one cut back, proved in tin 30 minutes, baked 50, water 19 qts. at 80°, bakehouse 70°. 15oz. salt (August).	Good tin, 89 marks. Flavour best, texture worst. Streaky. Yet wants more proof, warmer water, and more space in hotter oven. Keep covered. (7)
1 sack, half Eng. half Kansas.	$1\frac{1}{2}$lb.	Potato ferment with one-third water at 96° at 4, remainder at 112° at 5.30 for dough, cut back 7.30, out at 8, in oven 9.15, flour 64°, bakehouse 74°. $3\frac{1}{4}$lb. salt (October).	Good ordinary cottage outside, but disappointing inside. Hard core across centre from skin and cones. Holes from loose moulding. (8)
Batch of 100 quarterns, $\frac{2}{3}$ local supers, $\frac{1}{3}$ Kansas pat.	$1\frac{3}{4}$lb., and malt extract 8oz.	Straight dough, $5\frac{1}{4}$ hours, start to finish, flour 68°, water 106°. 3lb. salt (October).	Good ordinary all-round cottage. (9)
1 sack local pats.	$3\frac{1}{2}$lb., and malt extract 1lb.	Straight dough 3 hours start to oven. Dough, when made, 87°, baked at 500°. (November.)	88 points, good commercial, but not a prize winner. Deficient in bloom, and bottom crust burnt. Oven heated unevenly. Flavour best point. Loaf rushed too much. (10)
1 sack.	2lb., and 1lb. food.	Straight dough, finished 6 a.m., cut back, 7.15, on boards at 8, in oven 9.30, baked 55 minutes, water 108°. 3lb. salt (November).	Good all-round commercial loaves. Cottage stands up well, and cuts well. (11)
1 sack (280lb.), half local fines, half Amer. (not best).	2lb., and fruit 5lb.	Straight dough, 5 a.m., water 110°, cut back 6 a.m., again at 7, and 8, thrown out 8.45, in oven 10 a.m. for 55 minutes, when set 510°, when drawn 460°. $3\frac{1}{2}$lb. salt (May).	Good loaf, distinctly above average from locality. Close, firm cutting, and little holey from lack of proof at final stage. Flavour good. Well baked. The labour at frequent intervals has much helped the flour. A great success for flour. (12)
Batch of 64 quarterns, flour 24s. (No. 1 London households, 21s. 9d.).	4oz.	Sponge 9.30 p.m., doughed 6.15 a.m., thrown out 7.30, in oven $1\frac{3}{4}$ hours afterwards, sponge $\frac{1}{3}$. $1\frac{3}{4}$lb. salt (July) (4oz. in sponge).	Good tin loaf, excellent for flour. Nice flavour, nice oven, nice colour. (13)
85 quarterns ($\frac{2}{3}$ Fines, $\frac{1}{3}$ supers and quarter bag 1st Amer. pats).	1lb.	Sponge 5.30 a.m., with half liquor at 105°, dough 9.30 at 90°, cut back 10.15, thrown out 10.45, in oven 12 for 1 hour. $2\frac{3}{4}$lb. salt (August).	Very disappointing when cut. Nothing outside to indicate holes, yet several dull and smooth ones, entirely from skin folded in and the cones sticking to it, can be plainly seen inside. (14)

HAMPSHIRE AND ISLE OF WIGHT METHODS (WINCHESTER, SOUTHAMPTON, &c.).

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
2 sacks fines.	2lb., and 12oz. sugar, 12oz. malt.	Sponge, half liquor at 9.30 p.m. till 6 a.m., dough $\frac{1}{2}$ hour.	Good ordinary loaf, cottage, 70 marks (see Nos. 3 and 4 from same man). (1)

Hampshire and Isle of Wight Methods (Winchester, Southampton, &c.)—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack.	12oz., and 12lb. fruit.	Ferment at 80°, 4 to 5 hours, almost total liquor, 2lb. flour, dough at 95° for 3 hours. 3lb. salt.	Excellent loaf. (2)
1 sack fines.	1lb., and sugar 8oz., malt extract 8oz.	Sponge at 9 p.m., with half water, drop $\frac{1}{2}$ inch, dough 6 a.m., stand half hour, cut back, in oven 8.30. 3lb. salt.	Fuller but less bloom than No. 4, 71 marks. Texture poor. (3)
Same as No. 3.	$1\frac{3}{4}$lb., and malt extract 1lb.	Dough right off, water 112°, stand $1\frac{1}{2}$ hours, cut back another half hour, baked 45 minutes. 3lb. salt.	71 marks, volume and texture worst points. Too green, flavour and crust better than No. 3. (4)
9 bushels, $\frac{2}{3}$ fines, $\frac{1}{3}$ (Winchester) pat.	26oz., and 12oz. malt extract.	Off-hand dough, machine made, in trough $4\frac{1}{2}$ hours, cut back 40 minutes, and in oven 7 hours after liquor at 63° put to flour.	Good all-round cottage. (5)
280lb., households and fines.	12oz. yeast and 7lb. fruit.	Sponge 7 p.m., and dough 6 a.m., and stand $\frac{1}{2}$ hour.	Not overworked. Loaf above average. (6)
1 sack (280lb.).	12oz., and 1 quart hops liquor (4oz., boiled for 3 hours).	Slack batter sponge at 9 p.m. till 5 a.m., with 4 pails at 84°, dropped $\frac{1}{2}$ inch, dough 1 hour, in oven at 8 a.m. for $\frac{3}{4}$ hour, being 515° when shut down and 460° when finished setting, bakehouse 72°. 3lb. salt (May).	Good medium cottage, satisfactory for price of flour. Better if exposed to more heat in oven. Discard the hops liquor—long boiling of hops never good. (7)
1 sack; half fines, $\frac{1}{4}$ Amer. pats., $\frac{1}{4}$ Winton pats.	8oz., and malt extract 1lb.	Straight dough 9.30 p.m., water 70°, bakehouse 80°, cut back 6.30 a.m., thrown out 7.30, in oven 9 a.m. 3lb. salt (September).	Good, wholesome, nice-eating, all-round cottage. Too long, however, in trough, and not enough after throwing out. (8)
35lb. Exhibition flour ($\frac{1}{8}$ sack).	6oz., and sugar 2oz.	Straight off dough, 7 hours, made 4.45, tinned 10.30, in oven 11.45, 2 gallons water. 8oz. salt (July).	Excellent tin loaf, 95 points. Would appear better colour if texture finer. Little overproved. (9)
$\frac{1}{2}$ sack fines.	4oz.	Straight dough 10 p.m., thrown out and scaled off 6 a.m., baked 45 minutes. $1\frac{1}{2}$lb. salt (August).	Fair medium tin loaf for hungry mechanic. Doughy and heavy in hand. Underworked, underproved, and underbaked. (10)
Batch of 50 gals., price 10d. (No. 1 households) 22s. 6d.	8oz.	Sponge 7 p.m., water 72°, 2 buckets, dough 7 a.m. with 3 buckets (fully), 1 hour, cut back, throw out at 9, in oven 10.30. $3\frac{1}{2}$lb. salt (September).	Indifferent cottage in all points. Too much fermented. (11)
1 sack.	$2\frac{1}{4}$lb., and malt extract 1lb.	Straight dough 5 a.m., finished mixing 5.45, in trough till 7.45, cut back, thrown out 8.45, in oven 10, out 11 a.m., flour 64°, water 104°, when made 84°. $3\frac{1}{2}$lb. salt (October).	Good cottage. No holes, in spite of fairly short time between trough and oven, but dough is working quickly, and not baked as quickly as should be. (12)
38 gals. dough.	5oz.	Overnight dough at 8.15 p.m, cut back 6.15, another 2 hours, thrown out, handed up, proved 1 hour, moulded, proved 20 minutes, baked 55 minutes. $2\frac{1}{4}$lb. salt (December).	Fairly good cottage, better than most from such a process. Big loaf. Better to give time after moulding than after handing up. (13)

A COLLECTION OF VIENNA BREADS.

Hampshire and Isle of Wight Methods (Winchester, Southampton, &c.)—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
$\frac{1}{2}$ sack fines.	8oz., and 6oz. malt extract.	Straight dough, 4 hours, cut back, then 2 hours more, eight hours start to finish, water 108°. $1\frac{1}{2}$lb. salt (April).	Good ordinary all-round typical provincial cottage, 83 points. No specially good or bad features. (14)
$\frac{1}{2}$ sack ($\frac{1}{2}$ fines, $\frac{1}{2}$ pats.).	8oz., and 8oz. malt extract.	Straight dough, 6 hours start to finish, water 113°, leaving dough at 92° when made. $1\frac{1}{2}$lb. salt (April).	Much better, 85 marks, than a ten-hours' sponge loaf sent same time, from same flour, in all respects. (15)
1 sack ($\frac{2}{3}$ local fines, $\frac{1}{3}$ local pats).	12oz., and sugar 1lb.	Sponge 8.30 p.m., with half liquor, taken 5.30 a.m., in oven 9 a.m., baked 55 minutes. 3lb. salt (July).	Ordinary loaf as sold for tin in these parts, but better with more water and freer working, and baked less time in hotter oven. (16)
1 sack ($\frac{2}{3}$ Anglo-Hungarian, $\frac{1}{3}$ local supers).	2lb., and malt extract 8oz.	Straight dough started 4.30, cut back 6.30, thrown out 7.15, in oven 8.30, for 45 minutes. 3lb. salt (October).	Customers like it better than the sponge bread Stands up like a pyramid. Tight and unrecovered after moulding, therefore holes. (17)
140lb. Amer. pats., and 140lb. local.	10oz., and sugar 1lb.	Straight dough 6 p.m., water 78°, out of trough 7 a.m., baked by 9. $3\frac{1}{4}$lb. salt (October).	Fair saleable loaf. No bloom. Holes. Wants less in trough, and more after moulding. (18)
50 gals. bread, fines and local pats.	12oz., and malt extract 1lb.	Straight dough 10 p.m., cut back 6 a.m., thrown out 7, in oven 9.15 for one hour, water 85°, bakehouse 70°. 3lb. salt (November).	To avoid holes use more of the "trusty" local patents. (19)

HERTFORDSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
$1\frac{1}{2}$ sacks.	1lb., and 14oz. malt extract.	Straight dough 9 hours, in oven in 11 hours from start. 4lb. salt.	Good average loaf, small, and well finished on crust, but texture not good. (1)
7 bushel batch.	1lb., and few potatoes.	Sponge 8.30 p.m., dough 5.45 a.m., in oven 8.30, drawn 9.30 a.m. $3\frac{3}{4}$lb. salt (December).	Variegated crust. Too much yeast in sponge for the time. Too much fermented in sponge, and not enough in dough. (2)
90 quarterns.	8oz., and sugar 12oz., and half peck fruit.	Sponge 7 p.m., $2\frac{1}{2}$ pails liquor at 88°, taken at 4 a.m., with 2 pails at 100°, thrown out 6 a.m., in oven 7.45, baked 50 minutes. $2\frac{3}{4}$lb. salt (April).	Nos. 3 and 4 received same time; the former is the better and worth 85 marks. Better made, better proved, better volume, texture, and better baked It can be obtained just as spongy and bold without potatoes as with. (3 & 4)
85 quarterns.	8oz., half peck fruit.	Sponge 7.30 p.m., 2 pails at 80°, taken 4.30, with $2\frac{1}{4}$ pails 75°, thrown out 9a.m., in oven 10.30. $2\frac{3}{4}$lb. salt.	
1 sack country households.	8oz., and potatoes $\frac{1}{2}$ peck.	Straight dough 8 hours, cut back, give another hour. $2\frac{1}{2}$lb. salt (April).	Very fully worked. Twangy, omit fruit and increase salt. (5)

HERTFORDSHIRE METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
300 half-quartern (1 sack Minn. first pats., and 1 (4 bushel) sack country whites).	$2\frac{1}{2}$lb., and malt extract 1 pint.	Straight dough 10 p.m., cut back midnight, thrown out 1 a.m., in oven 2.45 a.m., baked 45 minutes, liquor 100°. 5lb. salt (August).	A good cottage, well made, well and cleanly moulded, well baked, very healthy, sweet and nothing whatever to complain about. (6)
1 sack town whites, $\frac{1}{2}$ bushel first Minn. pats., and nearly 2 bushels other.	9oz., and food 9oz.	Straight dough 10 p.m., cut back 6.30 a.m., thrown out 7.20, in oven 8.15 a.m., liquor 80°. $3\frac{1}{2}$lb. salt (August).	Bread good, except after it was thrown out of trough —no proof. Loaf green or immature—red crust. (7)
1 sack.	$2\frac{1}{4}$lb.	Straight dough, flour to loaf $4\frac{1}{4}$ hours, baked $\frac{1}{2}$ hour. $4\frac{1}{2}$lb. salt.	Excellent, but little too free. (8)
1 sack Exhibition.	2lb., and malt extract 12oz.	Straight dough, 80° when made, water 88°, flour 64°, flour to loaf nearly $5\frac{3}{4}$ hours, two cuts back. 4lb. salt.	Wants more in trough and tin. (9)

KENTISH METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack American patents.	$1\frac{3}{4}$lb.	Dough right off with water 110° F. (March). Lie in machine $2\frac{1}{2}$ hours, thrown out, rise another $1\frac{1}{2}$ hours, oven closed in 5 hours from start. 3lb. salt.	Bad shape. Complains of sticky dough. Loaf under ripe and underproved, but has many good points—88 out of 100. (1)
280lb., English patents.	18oz., and 1lb. malt extract.	Straight off, machine made, dough 6 hours at 70°, then cut back, start to finish 10 hours, baked 450° (August). 3lb. salt.	Good all-round cottage—80 marks. (2)
4 bushels, Eng., and 1 bush Amer. pats.	5 pints, patent or home-brewed.	Sponge 7.30, dough 6 a.m., being $10\frac{1}{2}$ hours in sponge and 5 in dough. $3\frac{1}{2}$lb. salt.	83 marks. Ferment better with patent. Thick streak between top and bottom, because of slow dough and compression. (3)
1 sack supers.	$2\frac{1}{2}$lb., and 12oz. malt extract.	Straight dough at 100°, made 7.15, in oven 9.5, bakehouse and flour 75°. 3lb. salt. (August).	Good cottage—82 marks. 45 notches on top. Crust colour and texture lowest. (4)
1 sack, half best Amer. spring pats. and $\frac{1}{2}$ Eng. pats.	14oz., and 1lb. extract.	Straight dough, machine made at 8 p.m., cut back 3.30 a.m., out of oven 8 a.m., 16 gallons water 80°. 3lb. salt (November).	Ordinary cottage, not good enough for flour—78 marks. Hanging about too long, too sluggish and cold. (5)
$6\frac{1}{2}$ bushels (country whites, and mostly country households).	8oz.	Sponge 8 a.m., at 95°, doughed 3 a.m. at 100°, one hour. $3\frac{1}{4}$lb. salt (November).	Normal loaf, but rather dry. Wants slacker dough and baking quicker. (6)

Kentish Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack ($\frac{1}{2}$ first Amer. spring pats., $\frac{1}{2}$ Eng. pat.).	1lb., and malt extract 1lb.	Straight off dough, 10 hours from flour to finished loaf, 15 gallons water 90°, oven 450° F. (November.)	Pretty and very good all-round coburg ; just a little too close and firm for the variety. Cottage is not so good. (7)
1 sack.	1lb.	Straight dough machine made at 7 p.m., cut back 3 a.m., thrown out 5 a.m., in oven 7, for 50 minutes at 470°. (June.)	Tight and bound cottage. Big hole from bashing and abrupt closings. Throw out when now cutting back, and hand up twice instead. (8)
1 sack.	12oz.	Straight dough 9 p.m., cut back 5.30, rise 1 hour, in oven 8 a.m., water 90°. 3lb. salt (May).	Good cottage—85 marks. Nice and bright crust. Well baked. (9)
Batch $4\frac{3}{4}$ bushels ($\frac{1}{3}$ town whites, and $\frac{2}{3}$ households).	7oz., and fruit $2\frac{1}{2}$lb.	Sponge 9 p.m., water 86°, flour 74°, bakehouse 70°, dough 4.30 a.m., cut back 5.20, thrown out 6.10, in oven 7.10, drawn 7.45 a.m. $2\frac{1}{4}$lb. salt (July).	Very good indeed—cottage. Everything good except stewy oven. (10)
3 sacks.	$3\frac{1}{2}$lb., and $1\frac{1}{2}$lb. malt extract.	Ferment 4 gallons water at 80° for $4\frac{1}{2}$ hours. Dough with another 28 gallons at 80°, in trough $4\frac{1}{2}$ hours, in oven $1\frac{1}{2}$ hours after. Baked 40 minutes. Machine made and cut back in $2\frac{1}{2}$ hours. Oven 520-500°. $9\frac{1}{2}$lb. salt.	Very good commercial bread. (11)

LEICESTERSHIRE AND NOTTINGHAMSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
34 stones country seconds and 2 stones Amer. pats.	$1\frac{1}{4}$lb., and 20lb. fruit.	Ferment at 75° for 9 or 10 hours, with 24lb. flour and 3 pails water, dough 90°, tightening gradually, $1\frac{1}{4}$ hours, 4 hours to oven. 6lb. salt.	Average tin, flavour low. Wants freer dough and less time ferment—69 marks. (1)
1 sack English.	14oz., and 10lb. fruit, 8oz. malt extract.	Ferment 6 hours, 31 quarts at 85°, dough $1\frac{1}{4}$ hours, 31 quarts at 95°, baked 50 minutes. 3lb. salt.	Good tin loaf—82 marks, but texture wants improving. More labour in dough to clear. Nice crust. (2)
100 loaves (2lb.) local households.	1lb.	Straight dough 6 a.m., scaled 8.30, in oven 9.30 for $\frac{3}{4}$ hour. $1\frac{1}{2}$lb. salt (July).	Fairly good cottage, good flavour. Bash and press down less. (3)
10 stones local and 10 stones port, average 23s. 6d. per 280lb. (London No. 1 households, 22s. 6d.).	$1\frac{1}{4}$lb. ($4\frac{1}{2}$d. quartern retail and 4d. wholesale).	Straight dough, 80° when made, bakehouse 60°, finished making 5.30, cut back 8, thrown out 9, tinned 10.30, in oven 11.15 for $\frac{3}{4}$ hour at 490° when set, $19\frac{1}{2}$ gallons water (?). $3\frac{1}{2}$lb. salt (July).	Poor—65 marks, flavour most, texture least. Thrown into tin without any workmanship. Process fairly right. (4)
1 sack Exhibition flour.	$2\frac{1}{2}$lb.	Straight dough, started at 11.15, made by 11.35, cut back 12.35, out 1.20, moulded for oven 2.40, in oven 3, drawn 3.55, water 16 gallons 95°, flour 72°, when made 85°, bakehouse 73°. 3lb. salt (Sept.).	Cottage—78 marks, flavour best, volume low, and crust colour, being red, low. Dough not ripe. Too much water for cottage. Not good enough for flour. (5)

LEICESTERSHIRE AND NOTTINGHAMSHIRE METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack best British pats.	1lb., and malt extract 8oz.	Straight dough 4.30 a.m., turned 7.30, again 8.30, out of oven 11, baked 45 minutes, water 85°. $3\frac{1}{2}$lb. salt (October).	White, hard, close, bound and small cottage. Holey at top. More water, more proof. (6)
1 sack (280lb.) at 20s. 6d.	(No. 1 London households, 22s.)	Straight dough, said to yield 30 stone (120 quarterns to sack), at an extra cost of 1s. 6d. for added material, no malt extract. (June.)	Good loaf for price of flour, the quality for the flour being almost as exceptional as the stated yield. (7)
15 stones, Liverpool flour at 27s. 6d.	14oz. (No. 1 households, 21s. 3d.)	Straight dough, time from start to oven $4\frac{1}{2}$ hours. dough 82°. 14 oz. salt (July).	Bad result for the good flour. Close, underworked, and holey. Wants more fermentation in trough and tin. Flavour all right. (8)

LINCOLNSHIRE METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack, $\frac{2}{3}$ households.	10oz., and 7lb. fruit.	Straight dough 6.30 p.m. till 5.30 a.m., in oven 7, liquor 70° F. (May). $3\frac{3}{4}$lb. salt.	Good average tin for flour. Nicely baked, not well mixed, low in colour and texture. Warmer liquor and less time trough would improve. (1)
20 stones.	14oz.	Ferment at 100°, at 4 a.m., dough at 5 p.m. at 86°, weigh 7.30 a.m., oven 560° for 45 minutes. 3lb. salt (October).	Fair average—66 marks. Ferment too hot. Pyrometer must be wrong. Is weighed in at 2lb. 4oz. (2)
50 stones ($2\frac{1}{2}$ sacks) country at 22s. 6d.	2lb. brewers' yeast and 1 peck fruit.	Sponge 10 p.m., all cold water, bakehouse 70°, dough 6 a.m., bakehouse 60°, water 80°, baked 65 minutes. (No. 1 London households 23s.). 6lb. 14oz. salt (May).	Flour exhausted without loaf being aerated. Very bad, heavy and nothing but holes. Starved, wants waking up by more yeast and heat in dough. (3)
1 sack ($\frac{3}{4}$ local at 23s. 6d. and $\frac{1}{4}$ Amer. pats. 24s. 6d.).	8oz.	Sponge 10 hours, baked 70 minutes in a stick oven. (No. 1 London households 23s.). $3\frac{1}{2}$lb. salt (May).	Better than No. 3. Hard cord across centre through pieces getting skin before topping. Baked too long. (4)
1 sack best Lancashire pats. (5 bushels).	2lb., and malt extract 12oz.	Straight dough at 5.50 a.m., flour 64°, water 88°, and when made 80°, cut back 7 a.m., again 8.15, tinned 9.20, in oven 10.15 for $\frac{3}{4}$ hour at 450°. 4lb. salt (June).	Good tin loaf—87 marks. Good volume, robustly healthy and nice bright crust. Texture little hard and crust round and bursts, being sharp and flinty, therefore little under ripe. Bake warmer. (5)
180lb.	1lb. 10oz.	Straight dough, water 110°, time from start to going into oven $4\frac{1}{2}$ hours, in oven $\frac{3}{4}$ hour. 2lb. salt (June).	Overworked in trough, but just right in tin. Although practically same time as No. 5 is much more worked, and texture is softer and better, although rather crumbly—73 marks. (6)
1 sack local (half 23s. 6d. and half 22s.).	12oz., and fruit 18lb.	Straight dough 9.30 p.m., cut back 3.30 a.m., thrown out 4.30, in oven 6 a.m. for 55 minutes at 450°, heat of dough 76°, bakehouse 70°. $3\frac{1}{2}$lb. salt (July).	Average—69 marks. Flavour and moisture all right. Colour poor. Omit potatoes and make slacker. (No. 1 London households 21s. 9d.). (7)

LONDON AND MIDDLESEX METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack (Town whites and households and country).	14oz. and fruit.	Sponge $4\frac{1}{2}$ hours, dough $1\frac{1}{2}$ hours, cut back once, in oven 2 hours from throwing out. 3lb. salt.	Good loaf except hole just under bash, by bashing too heavily. Hole measures 2in. long and $1\frac{1}{4}$in. high. (1)
280lb. (3 parts town households, some whites and little country).	2lb.	Batter sponge for half hour, water 110° (February), dough 100° for hour. 3lb. salt.	No. 2 is a "small top" home-made, and is better than the cottage (No. 3) from same flour and maker, being worth 81 and 75 marks respectively. (2 & 3)
	10oz., and 1 pint liquid brewers'.	Ferment $3\frac{1}{2}$ hours at 82°, sponge 7 hours 82°, dough at 94°, 4 hours to oven. 3lb. salt.	
$\frac{2}{3}$ of sack.	1lb., and 6oz. malt extract.	Dough straight off 5 a.m., water 110° (May), in oven 10 a.m.	Nice cottage—83 marks. Eats well, but not well finished. More care and manipulation; slightly under-ripe. (4)
1 sack (half town households and half Amer. super.).	1lb.	Straight off dough at 12.30 a.m., cut back 4 a.m., out of trough 5 a.m., in oven 6.15, drawn 7, water 90°. $3\frac{1}{2}$lb. salt (September).	Good-flavoured, solid-cutting, and small cottage—77 marks. Home-made character. (5)
1 sack.	$2\frac{1}{2}$lb.	Off-hand dough, water 100° (86° when finished making), 3 hours trough, cut back twice, out of oven in 5 hours from start. 3lb. salt.	79 marks, beautiful colour, texture too solid for the majority. (6)
1 sack.	$1\frac{1}{2}$lb., and 8oz. malt extract.	Half sponge 4 hours. dough $1\frac{1}{2}$ hours (including cut back). $3\frac{1}{2}$lb. salt (10oz. in sponge).	Good cottage—84 marks. Spoilt in finishing. (7)
1 sack, half Amer. pats. and half country pats.	12oz., and 8oz. malt extract.	Straight off at midnight, water 95°, cut back 4.30 a.m., thrown out 5.30, in oven 7.30. 3lb. salt (Nov.).	Good specimen of good class London family trade. (8)
84lb.	12oz., and sugar 1oz.	Straight dough $2\frac{3}{4}$ hours from start to oven, baked 50 minutes, 11 quarts water at 120° (yeast dissolved at 90°), bakehouse 60°. 12oz. salt (Jan.).	Very good tin loaf, well worth sending to exhibition. Wants hotter oven, as fermented too long after getting there, and inclined to be crumbly. (9)
4 bushels dough.	1 pint brewers', 3oz. French, 6lb. fruit.	Sponge 8 hours at 84°, dough $1\frac{1}{2}$ hours in trough, baked 45 minutes, bakehouse 70°. (June.)	Medium cottage, better inside than out. Skin instead of crust on outside. Wake up dough. (10)
1 sack. Country whites and best pats. (Amer.).	8oz., and malt extract 8oz.	Straight dough 10 p.m., cut back 5 a.m., in oven 8 a.m., water 80°. (August.)	Extra well finished cottage on outside, little holey and not top colour inside—87 marks. Too sluggish. (11)
Batch of $7\frac{1}{2}$ bushels. Flour average 24s. 3d., bread 5d. quartern.	$1\frac{1}{2}$lb., and malt extract $\frac{3}{4}$lb.	Straight dough 5 a.m., cut back 7 a.m., in oven 10.15, drawn 11 a.m., flour 60°, water 110°. $3\frac{3}{4}$lb. salt (October).	Wholesome, good eating cottage, with good base of fermentation, but hastily and roughly finished. Time rather short for amount of yeast. (12)
34lb. Exhibition flour.	10oz., and 4oz. sugar.	Straight dough $2\frac{3}{4}$ hours from start to entering oven, 6 quarts water. 4oz. salt (October).	Very good cottage. No holes, but texture inclined to be too coarse for prize-winning. More labour and time after. (13)

London and Middlesex Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality
1 sack town whites.	$1\frac{1}{4}$lb.	Straight dough, 5 hours, cut back, give another $1\frac{1}{2}$ hours, knock down, another half hour, thrown out and in oven in 80 minutes, proving 20 after moulding, baked $\frac{3}{4}$ hour. 3lb. salt (November).	Good on the whole, good exterior. Pulled up one side by undue exposure to heat of oven, and has hole in consequence. (14)
Town whites (mostly), and household and Amer. pats.	$1\frac{1}{2}$lb. to 15 bushels, and 14lb. potatoes.	Sponge $6\frac{1}{2}$ hours at 86° with half liquor, dough at same heat one hour (March). $\frac{1}{2}$lb. salt to bushel.	Fully ripe, but not sour as complained of by customers. Omit the fruit. Batch has got ahead on boards. (15)
1 sack.	12oz.	Straight dough, in trough 8 hours, water about 80°, to leave dough when mixed at 76°-80°. $3\frac{1}{2}$lb. salt (Aug.).	Recommended to an inquirer wanting this time in trough and found successful. (16)
Half local extras and half Amer.	8oz. (and 12lb. fruit in ferment) and 2oz. in dough.	Ferment 6 p.m., $1\frac{1}{2}$ pails, and 4lb. flour, dough 1 a.m., $5\frac{1}{2}$ pails, thrown out 7, in oven 8.30 a.m. $3\frac{1}{2}$lb. salt (February).	Medium quality. Full supply of yeast, but checked later. (17)
Batch $6\frac{1}{2}$ bushels.	18oz.	Straight dough, 78°, made 11 p.m., cut back 5 a.m., thrown out 5.30, in oven 7.30, baked 50 minutes. $3\frac{3}{4}$lb. salt (August).	Typical ordinary London household loaf for quality of flour. Normal all the way through. (18)
1 sack.	$1\frac{1}{2}$lb., and malt extract 1lb.	Straight dough, water 115° (85° to 90° when made), two hours, cut back, then half hour, out of oven in 5 hours from dough making. $2\frac{1}{2}$lb. salt.	Good. With dough at 80° when made, and time 6 or $6\frac{1}{2}$ hours in trough, according to volume and ripeness required, yeast should be 1lb. and salt $3\frac{1}{2}$lb. (19)
1 sack.	10oz., and malt extract 1lb. in ferment.	Ferment when set 85°, 4lb. flour, give 3 hours, dough 85° when made, give 4 hours, cut back and another half hour. $2\frac{1}{2}$lb. salt.	Good. (20)
1 sack.	10oz., and malt extract 1lb.	Sponge 7 hours at 80° when finished making, dough $1\frac{1}{2}$ hours. $3\frac{1}{2}$lb. salt.	Good average. (21)
$\frac{1}{2}$ sack.	$1\frac{1}{4}$lb., and malt extract 8oz.	Straight dough, 7 gallons at 100°, cut back at every half hour and thrown out at 2 hours (86° when made). $1\frac{1}{2}$lb. salt.	Exhibition quality—cottage. Thorough kneading, keeping covered, and good proof makes much of the perfection. (22)
$\frac{1}{2}$ sack Exhibition.	$1\frac{1}{2}$lb., and malt extract 8oz.	Straight dough, 84° when mixed, 5 hours to oven closing. $1\frac{3}{4}$lb. salt (September).	Good tin. (23)
18lb. Exhibition.	3oz., and malt extract 2oz.	Straight dough with 1 gallon at 90° (82° when made), flour 70°, dough making to oven $5\frac{1}{4}$ hours, two cuts back, baked 45 minutes. 5oz. salt.	Exhibition cottage. (24)

LANCASHIRE METHODS (LIVERPOOL, MANCHESTER, ETC., AND ISLE OF MAN).

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
Made eighty 8lb. loaves.	3lb., and malt extract 10oz.	Straight dough 12.30, turned 1.30, knocked down 2.30, scaled, proved, in tin $\frac{1}{2}$ hour, and then removed and moulded, in oven 5 a.m., bakehouse 70°, flour 68°, water 98°, dough when made 82°, oven 475°, baked 50 minutes. $7\frac{1}{2}$lb. salt (January).	Very good tin, but unevenly baked, and in a tin too small. Streaks in crumb through chill on outsides, which are afterwards turned inside. (1)
280lb. (1 sack).	$2\frac{3}{4}$lb., and malt extract 1lb.	Sponge 45 minutes at 90°, doughed 90°, $4\frac{1}{2}$ hours in all. $3\frac{1}{2}$lb. salt (February).	Beautiful tin loaf. Exceedingly light and nice to eat, but not filling ; not overproved. (2)
1 sack.	$2\frac{1}{4}$lb.	Water 18 gallons at 110°, straight dough, all made at 8, scaling 9.30, in oven 11. $4\frac{1}{2}$lb. salt (February).	Good ordinary tin loaf from flour. Heaviness at sides of loaf through being too closely packed in oven. (3)
14 dozen local pats.	1lb., and sugar 7oz.	Straight dough, machine made 4 a.m., $38\frac{1}{2}$ quarts water 100°, thrown out 6 a.m., moulded straight into tins, oven shut 8.40, drawing finished 9.30, oven 530° at setting, and 460° just before drawing. 28oz. salt, and fat 28oz.	Good bread. Machine has thoroughly well made the dough. Few holes from unevenly distributed gas. (4)
1 sack best local pats.	$2\frac{1}{2}$lb., and malt extract 12oz.	Straight-off dough, 15 gallons water 95°, flour 65°, bakehouse 75°, cut back 1 hour, again in an hour, rise another hour, in oven $4\frac{1}{2}$ hours from start 3lb. salt (April).	Excellent flour, good process, good bread, but not well finished—85 marks. Wants better moulding and more steam in oven. (5)
1 sack local.	3lb.	Straight dough at 12.45, cut back at 2, on table 2.45, in oven 4.40, baked 40 minutes at 550° F., 15 gallons water at 95°. 4lb. salt (April).	Excellent tin loaf, but barely as good as No. 21, from same man. Wants more room in oven. (6)
Batch of forty 8lb. loaves.	$1\frac{1}{2}$lb., and malt extract 5oz.	Straight dough, cut back in 1 hour, again in 2 hours, well proved in tins before turning, start to oven $4\frac{1}{2}$ hours, baked 50 minutes in oven 500° (when setting), water 15 gallons at 90°, flour 60°, bakehouse 78°, finished dough 80°. $3\frac{1}{2}$lb. salt (June).	Very good tin loaf, precisely the same throughout as No. 1 from same man. Underproved after turning in tin, therefore little holey. Baked too long—burnt on top. (7)
1 sack Exhibition flour	3lb., and malt extract 12oz.	Straight dough $6\frac{1}{2}$ hours, 14 gallons water 100°, flour 70°. 3lb. salt (August).	89 marks. Crumb colour best, texture worst. Very few cottages received from here—mostly tins. Good. (8)
Batch equal 76 loaves (8lb.), Exhibition flour.	$2\frac{1}{2}$lb., and malt extract 1lb.	Straight dough 3.30, cut back 4.30 again, in oven 7.30 for $\frac{3}{4}$ hour, water 100°. $5\frac{1}{2}$lb. salt (Sept).	Nice every-day tin, but not prize quality. Too tight, small, and underproved. (9)
$51\frac{1}{2}$lb.	9oz., and sugar 3oz.	Straight dough from start to oven 4 hours, 3 gallons water. $13\frac{1}{2}$oz. salt (August).	Beautiful. The very best tin received out of 1,000 loaves. 96 marks out of 100. Diagrams kept. (See next.) (10)
35lb. Exhibition flour.	6oz., and sugar 2oz.	Straight dough at 85° when made, 4 hours start to oven, baked $\frac{3}{4}$ hour, water 2 gallons. 9oz. salt (September).	Excellent loaf, but not quite so good as No. 10, from same man. Trifle overproved and underbaked at sides. (11)

Lancashire Methods (Liverpool, Manchester, &c., and Isle of Man)—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
280lb. local.	$2\frac{1}{4}$lb.	Straight dough 11 a.m., heat when made 86°, in trough $1\frac{1}{4}$ hour, handed up into tins, proved 1 hour, taken out, moulded, proved again in tins 1 hour, in oven 2.45 p.m., baked 40 minutes, $16\frac{1}{2}$ gallons water at 108°, bakehouse 78°. 3lb. salt (November)	Average medium all-round tin. Somewhat lumpy and rather coarse in texture. Is on the side of overproof at last—the opposite of the majority. (12)
20lb. flour, $\frac{1}{14}$ of sack.	7oz. (January).	Straight dough 45 minutes, in tins 45 minutes, baked $\frac{1}{2}$ hour in gas oven at about 450°. Baked loaf weighs barely $1\frac{1}{2}$lb. $3\frac{1}{2}$oz. lard (3lb. to sack).	Nice loaf, nice colour crust, nice eating for a change. (13)
1 sack ($\frac{2}{3}$ Vienna, $\frac{1}{3}$ Eng. pat.).	14oz., and 1lb. malt extract.	Sponged at 4 till 7.30, tinned at 10, turned, in oven 11.5. $3\frac{1}{2}$lb. salt.	Holes, otherwise good loaf in all points. Pieces of unbroken sponge caused holes. (14)
Pack of 240lb.	20oz., and 8oz. malt extract.	Straight off dough, 4 hours, cut back, rise another hour, 93° F. (March).	All-round tin loaf. (15)
280lb.	2lb., and 1lb. malt extract.	Dough straight off, stand $\frac{1}{2}$ hour, cut back, stand $1\frac{1}{2}$ hours, then tin. 3lb. salt.	Excellent tin—92 marks. Crust scorched, and holes just under it in consequence. (16)
280lb. best local.	2lb., and 8oz. malt extract.	Dough straight off, cut back, stand $1\frac{1}{4}$ hour, commence mixing 3.15 a.m., out of oven 7.30 ($4\frac{1}{4}$ hours). 3lb. salt (November).	Exceptionally excellent tin—95 marks. Flavour and volume perfect. (17)
280lb., local pat. and supers.	12oz., and 2lb. sugar.	Sponge water 75°, 2lb. lard, 1lb. tin condensed milk, batter 2 hours, dough 75°–80° for 2 hours. Total time $6\frac{1}{2}$ hours. 3lb. salt.	Good all-round tin—84 marks. Flavour unusual. Lard in dough, if anywhere, and less sugar. (18)
280lb. local.	2lb., and 10oz. malt extract.	Dough straight off, water 95° (February), being 5 hours from kneading to drawing from oven, oven 420°. 3lb. salt.	88 marks. Good tin, points being evenly divided between all the sections. (19)
1 sack local and Amer. pat.	$1\frac{1}{2}$lb.	Off-hand dough at 92° (February), $4\frac{1}{2}$ hours to oven, and baked 50 minutes. 3lb. salt.	Good ordinary all-round loaf, but not so good as No. 6. (20)
1 sack.	$2\frac{1}{2}$lb.	Straight off, 1 hour, cut back, leave another hour, flour 60°, water 115° (April), bake 40 minutes. $3\frac{1}{2}$lb. salt.	Excellent oval tin—95 marks. Nothing better wanted commercially. (21)
280lb.	2lb.	Straight dough, water 98°, made 5.30 a.m., in trough $2\frac{1}{4}$ hours, tins turned 9.15, in oven 10.15, baked 45 minutes (bakery 70°). 3lb. salt (June).	Tin loaves; good—80 marks. Not much difference in the two, on the whole. Sponge loaf whiter in crumb and less holey, but worse bloom on crust. Both small. (22 and 23)
Same.	6oz.	Sponge with half liquor 82° at 8 p.m., and 12oz. salt, taken 6 a.m., dough liquor 74°, in trough till 8, in oven 10.15. 3lb. salt.	

LANCASHIRE METHODS (Liverpool, Manchester, &c., and Isle of Man)—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack, $\frac{1}{2}$ local pats., $\frac{1}{2}$ Canadian pats.	$2\frac{1}{2}$lb.	Off-hand dough 6.15 a.m., thrown out 7.45, oven closed 10.15, opened 11 a.m., bakehouse 72°, water 98°. 3lb. salt (July).	From same firm as Nos. 22 and 23—worth 77 marks. More time in trough and more labour, and less yeast and more water. (24)
1 pack (240lb.).	$1\frac{1}{2}$lb., and 12oz. malt extract.	Straight dough 4 hours at 90°. 3lb. salt.	Good tin—80 marks. Compressed layers at side through lack of heat there. (25)
140 quarterns ($\frac{1}{3}$ Austrian, $\frac{2}{3}$ local pats.).	1lb. 10oz., and 8oz. malt extract.	Straight off at 2.30, water 90°, scaled 6.30, in oven 7.40, baked 45 minutes, bakehouse 70°. 5lb. salt (October).	Good tin—81 marks. Colour and flavour distinctly best. More fermentation wanted both in trough and tin. (26)
18 scores yielded 26 scores bread.	$2\frac{1}{4}$lb.	Sponge with 6 scores and 3 gallons water at 104° for $2\frac{1}{2}$ hours, dough at 100°, with 3 gallons milk and 3 gallons water. $4\frac{1}{2}$lb. salt (November).	79 marks, most for flavour and moisture, being excellent, and least for volume and shape. (27)
Half sack (local Exhibition).	1lb., and sugar 6oz.	Straight dough 5 a.m., turned and cut back 7 a.m., scaled and moulded 8 a.m., tinned 9 a.m., in oven 9.30, baked 10.15 a.m. Flour 80°, water 90°, bakehouse 78°. 24oz. salt (May).	First prize in "B.B." competition. A practically perfect tin. (28)
1 sack of same as No. 28.	3lb., and malt extract 8oz.	Straight dough in trough $5\frac{1}{2}$ hours, $13\frac{1}{2}$ gallons water at 95°, flour 65°, bakehouse 72°, dough when made $81\frac{1}{2}$°. 4lb. salt (May).	Third prize in same competition as No. 28. An excellent "crumby." (29)
32 quarterns (2 bushels).	10oz., and sugar 12oz.	Straight dough, flour 72°, water 104°, dough 7.30, cut back 8.45, again 9.45, scaled 10.30, in oven 10.55 for 55 minutes, bakehouse 82°. 1lb. salt, and lard 10oz.	A good tin loaf. Small batch. (30)

NORFOLK AND SUFFOLK METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack ($\frac{3}{4}$ country pats. and $\frac{1}{4}$ Amer. spring pat.).	1lb.	Straight dough 9 p.m. till 6 a.m., in oven 7.30, baked 45 minutes. 3lb. salt (March).	Poor loaf both inside and out. No finish, but wholesome. (1)
1 sack (280lb.).	2lb., and malt extract 12oz.	Straight dough in machine 5 a.m., cut back 7, in oven 9.30, baked $\frac{3}{4}$ hour at 450°, water 95°. $3\frac{1}{4}$lb. salt (August).	Excellent daily cottage. Nice shape. Little more proof, warmer oven and more steam; bloom wanted better. (2)
Half sack.	12oz., and malt extract 6oz.	Straight dough, liquor 95°, six hours from taking up water till baked. (September.)	Very good and satisfactory for everyday commerce. (3)

Norfolk and Suffolk Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
About 1 sack.	12oz., and malt extract 8oz.	Straight dough 9 p.m., medium stiffness, cut back 6 a.m., thrown out 6.30, in oven 7.45, water 13 gallons at 82°, produced 89 quarterns. 2½lb. salt (May).	Average country tin—69 marks. Wants to be freer, in larger tin, hotter oven with more space and better flour. Small and holey. (4)
112lb. country flour.	1lb. 4oz., and malt extract 3oz.	Sponge 5.30 a.m., scaled 8.30, in tins ½ hour, hot air oven from 9.30 to 10.15 at 470°, water 100°, bakehouse 72° (April). 1lb. 6oz. salt, and 1lb. lard.	Very fully proved and light tin loaf, rather coarse and crumbly. Rich crust. (5)
Batch of 2¼ bushels (households and 1 peck Amer. pats.), 5½d. qtn.	4½oz.	Straight dough 9 p.m., cut back 6 a.m., thrown out 6.30, in oven 7.45, baked 50 minutes, water 78°. (No. 1 London households 21s. 3d.) 18oz. salt (July).	Very poor indeed. Over-fermented in trough, under-proved in loaf, therefore bound and holey. (6)

NORTHAMPTONSHIRE AND RUTLAND METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack, local seconds.	8oz., and 8oz. malt extract.	Sponge at 90° (April) for 11 hours, dough 90°. 3lb. salt. (little in sponge).	A miserable cottage—to be guarded against. Worst seen for long time. Poor flour, poor process, poor skill. (1)
318 half-quarterns.	12oz., and 7lb. potatoes and 12oz. malt flour.	Sponge at 6 p.m. at 85°, dough 5.30 at 90°, all drawn 10.50 a.m. 5½lb. salt (April).	A poor thing—worth only 58 marks. Weak flour exhausted. Close and heavy, yet holes. Wants the opposite of malt flour. (2)
44 stones of bread, country straights.	18oz.	Ferment 9 p.m., 1lb. salt, 9 gallons water, 80° when set, and 4 stones flour, doughed 5 a.m. with remainder salt, water 90°, lie one hour, in oven 9 a.m. 6½lb. salt (April).	Immature, coarse, badly moulded. More flour in the "ferment" or batter sponge, or freer dough. (3)
Same size as No. 3.	2lb. 4oz.	Straight dough 6 a.m., water 80°, cut back 9.30, lie another hour, in oven 12.30. 6½lb. salt.	From same man as No. 3 and better—70 marks. Both doughs want to be warmer. (4)
1½ sacks.	1lb. 6oz., and malt extract 12oz., and scalded flour 3½lb.	Straight dough 9 p.m., cut back 6 a.m., in oven 9 a.m., water 90°, ⅚ fines at 22s., ⅙ best Minn. pats., bread 4d. (No. 1 London households, 22s. 9d.), bakehouse, 63°. 5½lb. salt (May).	Poor and exhausted. Crumbly tendency though moist. Broken down in crumb, but clinging still together because water retained by under baking. (5)
Local flour 22s., bread 4½d.	6oz., and malt extract 6oz.	Sponged 7.15 p.m., water 70°, dough 7 a.m., water 90°, thrown out 8 a.m., in oven 10 a.m., baked 45 minutes. (No. 1 London households, 22s.). 35oz. salt (June) (3oz. in sponge).	Poor loaves, overworked. Bad flavour, bad smell, and cold oven largely contributed. Sponge too long. (6)

NORTHUMBERLAND, CUMBERLAND, WESTMORLAND, AND DURHAM METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
280lb. English.	$1\frac{3}{4}$lb.	Batter sponge ready in 20 minutes, dough 2 hours, water 100°, baked in $4\frac{1}{2}$ hours start to finish.	Good average tin. (1)
8 stones American pats., 32 stones English pats.	2lb., and 1lb. malt extract.	Sponge 2 hours, at 98° water, start to finish 6 hours. 7lb. salt (October).	Good loaf—83 points out of 100. Colour, volume and shape best, other points equal. (2)
$\frac{1}{2}$ sack local flour 24s. (No. 1 households, in "Walker," 21s.)	1lb., and sugar 1lb.	Straight dough, water 106°, flour 72°, made 6.30, cut back 8.30, scale 10.45, oven 11.40, baked 50 minutes, yeast set 15 minutes in quart of water. 1lb. 14oz. salt (November).	Made holey and spoilt by small tin. Too much added sugar. Crumbly. Better if fermented less in trough. (3)
9 stones.	1lb.	Straight dough 6 a.m., cut back 8 a.m., thrown out 9, in oven 9.45, out 10.45 a.m., flour 60°, bakehouse 67°, water 110°, yeast dissolved at 95°. $1\frac{1}{2}$lb. salt (December).	Good loaf in many points, but very holey, partly by insufficient proof after moulding, and also here by leaving large bladders of gas by loose and insufficient moulding. (4)
$1\frac{1}{2}$ bags local pats. and whites.	4lb., and 1lb. sugar and 1lb. malt.	Sponge at 105° for 45 minutes, 2 quarts milk, five hours start to finish. $5\frac{1}{2}$lb. salt (May).	Good tin loaf, very light, nice to eat. Oven too stewy. (5)
1 sack British pats.	$1\frac{1}{2}$lb., and malt extract 8oz.	Sponge, water 95°, start to finish 5 hours. 3lb. salt (November).	Excellent tin bread. (6)
1 sack.	8oz., and malt extract 8oz.	Sponge 5 gallons 3 pints at 80°, 100lb. flour, for 10 hours, dough 180lb. flour, 8 gallons 3 pints at 120°, made at 3, in oven at 6, being in trough $1\frac{1}{2}$ hours, flour 58°, bakery 68°. $3\frac{1}{2}$lb. salt ($\frac{1}{2}$lb. in sponge) (March).	The best loaf seen from a 10-hour sponge (excluding Scotch). Is well steadied in sponge and stimulated in dough, but 2oz. or 3oz. yeast in dough would improve. (7)
1 sack English pats.	$1\frac{1}{2}$lb., and malt extract 1lb.	Ferment 1 hour at 100°, dough $2\frac{1}{2}$ hours, cut back once, baked $\frac{3}{4}$ hour at 480°, water 14 gallons. 3lb. salt (June).	Could well be left alone for a daily commercial loaf. Ferment too warm unless cooled by flour, etc. Hotter oven would be better, with more proof. (8)
1 sack English pats.	$2\frac{3}{4}$lb.	Straight dough, 16 gallons water at 125° F., made 3.45, out of oven at 8, being $4\frac{1}{4}$ hours from flour to baked loaf, bakehouse, 70°. 4lb. salt (Oct).	Beautiful bread—tin. Difficult to improve on for commerce, but just a little too free. (9)

SOMERSET METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack, $\frac{2}{3}$ fines, $\frac{1}{3}$ supers (English).	$1\frac{1}{2}$lb., and 8oz. malt extract.	Off-hand dough with liquor at 100°, rises 2 hours, cut back and throw out in another $\frac{1}{2}$ hour. 3lb. salt.	Good loaf for flour, being above average bread. Moist and short eating. A little on the free side, requiring hotter oven. (1)

Somerset Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
280lb. Leather Tie and Fines.	10oz., and 1lb. sugar.	Off-hand dough, start to oven closed 10 hours, baked 70 minutes, bakehouse 68° (July). 3¾lb. salt.	Crumbly. Over-fermented and in a cool oven too long. (2)
280lb., ⅔ fines, ⅓ Amer. springs.	1½lb., and 8oz. malt extract (dissolved with sugar and flour for ½ hour) at 90°.	Dough straight off for 2¼ hours, water 120°, flour 60°, oven closed 4¼ hours from starting, baked 1 hour, bakehouse 65° (December). 2½lb. salt.	Good all-round daily cottage. Very fully ripe and tight. Baked too long. Docker caused holes on top. Less yeast and less heat and longer time would suit flour better. (3)
1 sack local supers, at 26s., bread 4½d.	1¾lb.	Ferment 1 hour at 95°, dough liquor 94°, rise 1 hour, cut back, then ¾ hour, flour and bakehouse 60° (January), baked 55°. 2¾lb. salt.	Excellent all-round cottage for flour—90 marks. Ferment rather warm. (4)
1 sack.	2lb.	Straight-off dough, in oven in 4½ hours from start, water 103°, baked 55 minutes. (June).	Good all-round cottage (79 marks), but has got checked for the time. Crust red, underworked. Tight. (5)
1 sack at 24s. 3d., bread 5d. (No. 1 households in "Walker" 22s. 6d.).	1½lb.	Straight dough from start to oven 6 hours, flour 73°, water 95°. 3¼lb. salt (September).	Excellent everyday system—very hard to beat—for average flours. (6)
Batch 43 quarterns.	11oz.	Straight dough 8.15, knocked back 10.15, in oven 2.30 for 50 minutes, flour 67°, water 106°. 1lb. 6oz. (September).	Ordinary average country cottage. Flavour right, but dough not well cleared. (7)
Batch 96 quarterns.	1lb. 10oz., and malt extract 10oz.	Ferment 7.30 a.m., 86° F., dough at 9 a.m. at 98°, stood 1½ hours, cut back and stood another ½ hour, in oven 12.25. 3lb. salt (October).	Good ordinary process and good ordinary loaf; no special features. (8)
280lb. (fines, local supers, and Kansas, ⅓ each).	2¼lb., and sugar 2oz., and malt extract 8oz.	Yeast dissolved with sugar and 3lb. flour at 5.15 a.m. in bucket water at 90°, commenced dough 5.25 with water 110°, thrown out 7.20, in oven 8.45, baked 50 minutes. 2½lb. salt (December).	A modern process, but poor flour and only an ordinary country quality. (9)
7lb.	1oz.	Straight dough 3½lb., water at 100°, ½oz. sugar, leave 2 hours, knead again and give another 2 hours, put in tins and allow to rise to double size 1oz. salt.	A domestic recipe. See also article on "Home Made Bread." (10)

STAFFORDSHIRE AND SHROPSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack local seconds.	8oz., and 1lb. malt flour.	Dough right off at 110° (March), cut back in 2½ and 1 hour afterwards, out in 7 hours from start. 2¾lb. salt.	Average bread; but cottage (No. 2), in proportion to price of flour, not so good as tin. No. 1 worth 60 and No. 2 worth 61 marks out of 100. Volume and finish are worst points. (1 and 2)
Local pats. and supers.	Same as No. 1.	Dough right off at 100°, cut back in 8 hours, one after, out in 12 from start. 3lb. salt.	

STAFFORDSHIRE AND SHROPSHIRE METHODS—continued.

YEAST AND FOOD.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
Country pats., supers, and fines.	1½lb.	Slack sponge, 30 quarts water at 96° for 45 minutes, dough, 15 quarts at 96°, stand 1 hour, bake 50 minutes. 2½lb. salt (November).	Superior cottage. Oven too cool for bloom with soft flour, fully changed; evidently very full proof on boards—82 marks. Crumb colour best, flavour worst point. (3)
280lb. flour, 20s. 6d. (5 bushels), (No. 1 households in "Walker," 21s.).	2½lb	Water 115°, flour 60° F. (August), straight dough 3¾ hours from start to oven setting, machine-made and handed up twice. 3½lb. salt.	Average loaves—65 marks. Manufacture of loaf better than the quality of flour. Cottage looks better colour than tin, because less coarse. No holes. (4)
⅔ of sack local extras.	2lb.	Ferment with 3 gallons water, 96°, for 45 minutes, dough 7 gallons, 96°, flour 70°, one hour, cut back, then 45 minutes, baked 40 minutes. 2lb. salt (September).	Good ordinary tin. Ferment rather too warm, and yeast very full. (5)
16 stones.	2½lb.	Straight dough, water 90°, hand made, cut back in 1 hour, start to finish 3½ hours. 2½lb. salt (Sept.).	Beautiful loaf, but too bound. Fermentation good. No holes, but texture too hard. Dough too tight or not grown enough at last. (6)
32 stones (28s. per 5 bushels), retail, 5½d.	1¾lb., and 8oz. malt extract.	Straight dough, water 104°, bakehouse 75°, made 6.30 a.m., cut back 7.30, again 8.30, tinned 10, in oven 10.30, baked 35 minutes at 550°. 4lb. salt (September).	Good all-round commercial tin. London markets, as shown in "Walker's Notes," the same as mentioned in No. 4, above. (7)
4 bushels (21s.) "Pink Tie" (No. 1 households, 23s. 9d.)	1½lb., and 6oz. sugar.	Sponge 1¼ hours 94°, start to finish 5½ hours. 2lb. salt (August).	Good ordinary, everyday tin. Oblong holes from excess of undistributed gas before baking. (8)
1 sack of 224lb.	1¼lb., and malt extract 8oz.	Straight dough, liquor at 6.15, finished making 6.35, cut back 8.45, thrown out 10, in oven 12, baked 45 minutes, 52 quarts water at 110°, flour 52°, when made 81°. 2¾lb. salt (February).	Good loaf, well made with great pains and exceptionally well managed under difficulties. Dough when made was 81° (being exactly half the heat of water and flour combined), when cut back was 83°, when thrown out was 81°, and when going into oven was 78°. (9)
	15oz., and malt extract 4oz.	Straight dough 6.45 a.m. (kneaded 10 minutes), cut back 8.30, thrown out 9.40, in oven 11.35 for 45 minutes, 29 quarts water at 100°, flour 60°, when made 82°. 1½lb. salt (March).	Dough when made was 82°, when cut back was 82°, when thrown out was 80°, and when setting was 76°. Better than No. 9. (10)
Batch of 50 quarterns.	5oz., and sugar 5oz.	Sponged with 1 pail water 110° at 10 p.m., flour 81°, dough 7 a.m. with 1 pail at 100°, cut back 8.15, in oven 11 a.m. at 490°, when door closed, baked ¾ hour. (July).	Quite sour, one of the worst loaves received. Pale and pasty on top and discoloured all round sides. Heat for sponge, with sugar and no salt, simply atrocious for 9 hours in July. (11)
5 bushels Eng. milled yielded 94½ quarterns at 2lb. 3oz. the half.	1½lb. (loaf overweight, after going through post).	Straight dough 7 hours after starting machine to oven drawing, made 1.30 a.m., cut back 4.15 and 5.30, out 6.15, in oven 7.40, out 8.30 a.m., flour 75°, water 94°, dough made 82°. 3¼lb. salt (October).	Fermentation good. Better if thrown out earlier without cut back (machine dough should not need it), and then handed up twice and more time on boards. (12)

SURREY METHODS.

Flour.	Yeast and Flour.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
280lb. provincial whites.	$1\frac{1}{2}$lb. and 12oz. malt extract.	Off-hand dough, water 105°, $1\frac{1}{2}$ hours, cut back, $\frac{1}{2}$ hour, start to oven closed $4\frac{3}{4}$ hours. 3lb. salt.	Pretty cottage, stands up well. (1)
280lb.	12oz. and 12oz. malt extract.	Dough straight off, 9 hours, cut back, then another hour. 3lb. salt.	Average loaf, flavour worst point. (2)
52 quarterns bread.	6oz.	Straight dough, from flour to oven 9 hours, in oven hour at 450°, flour 50°, water 93°, when made 78°. $1\frac{1}{2}$lb. salt (February).	Ordinary daily tin loaf—not exhibition quality. Give more space and less time in hotter oven. (3)
Half sack competition flour.	8oz., and fruit 5lb.	Straight dough 10.30 p.m., cut back 5.30 a.m., thrown out 6.30, in oven 8 a.m. for 1 hour, handed up twice, dough when made 82°. 2lb. salt (Sept.).	Tin too small for exhibition, baked too long, got chilled on surfaces—streaks. Omit potatoes. (4)
Half sack South of England best pats.	$1\frac{1}{4}$lb., and malt extract 8oz.	Straight dough finished making 4.45, cut back at $\frac{1}{2}$ hour intervals three times, being well kneaded each time, 2 hours trough, proved $\frac{1}{2}$ hour after final moulding. In oven 8.10 for $\frac{3}{4}$ hour. Bakehouse 74°, flour 65°, water 103°, dough made 88° $1\frac{1}{2}$lb. salt (October).	Unusually excellent cottage, difficult to improve upon. Forty minutes after moulding would have been better as dough tight, or even more, and then hotter oven. (5)
$\frac{2}{3}$ country whites, $\frac{1}{3}$ first pats.	2oz., and malt extract 2oz. to the bushel.	Straight dough 8.30 p.m., water 90°, cut back 6.30, in oven 9 a.m., baked 50 minutes. Salt 8oz. to the bushel (December).	Country loaf of very ordinary quality, but eats all right. Roughly finished. (6)
1 sack.	12oz., and malt extract 8oz.	Sponge 8 p.m., water 85°, taken 4 a.m. at 85°, scale 6.15, in oven 7.30 for $\frac{3}{4}$ hour. 3lb. salt (January)	Overworked but underproved—that is, too much in trough, not enough after moulding. (7)
Local flour 7 bushels dough.	12oz.	Sponge 10 p.m., almost cold, taken 6.10 a.m., thrown out 8.30, in oven 9.40 a.m., baked 50 minutes. $3\frac{1}{4}$lb. salt (July). (4oz. in sponge).	Fairly good loaf except for bad moulding. Fully changed. Bad closings and no proof make hole big enough to hold a sausage. (8)

SUSSEX METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
5 bushels bread from local households.	1lb., and 1 gallon potatoes, and 8oz. malt extract.	Small ferment with flour and fruit and half yeast, sponge with malt and remainder of yeast 10 hours, dough 2 hours, bake 40 minutes, cold water throughout. (October.)	69 marks, volume and crumb colour the only points saving a bad total. Too much fermentation. Lost flavour. (1)
Batch 11 bushels.	14oz. (bakehouse 70°).	Sponge 9 hours, 13 gallons water 70°, $4\frac{1}{2}$ bushels flour, dough 5 bushels, 13 gallons water at 63°, heat of dough 80°, dough in trough $2\frac{1}{3}$ hours, on boards 70 minutes, including 20 after moulding, oven 450° when set, bake 55 minutes $6\frac{1}{4}$lb. salt (October).	Good all-round Coburg, as it ought to be for the flour and the sixpenny selling price (No. 1 London households in "Walker" 22s. 6d.). No holes. Flavour better if process shorter. Set it quite crusty. (2)

SUSSEX METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack (280lb.).	10oz. yeast, and malt extract 1lb.	Ferment 85° when finished setting, with 4lb. flour and extract for 3 hours, dough 85° to 90° when finished, rise 4 hours, cut back, another ½ hour and throw out. 2½lb. salt (February).	Excellent results can be obtained from this. (3)
240lb. best English pats.	1¾lb., and malt extract 1lb.	Straight dough, 5 hours start to finish. 2¾lb. salt (March).	Good tin loaf—88 marks. Slacker dough and larger tin wanted. (4)
1 sack (fines and ¾ bushel Amer. bakers).	2½lb., and malt extract 6oz.	Straight dough, commence 6.30 a.m., water 100°, cut back 8.30, throw out 9.40, in oven 10.45, cottage. 2½lb. salt (June).	Much superior to a loaf from same flour by a longer process with less yeast and heat—80 marks. (5)
Batch of 50 gallons bread.	12oz., and sugar 2oz.	Sponge 8.45 p.m., water 94°, bakehouse 72°, dough 6 a.m., bakehouse 68°, water 106°, cut back 8.45, commence scaling 10.15, oven closed 11.45 a.m. 3lb. salt (April). (1lb. in sponge.)	A really dreadful sample. Not sour or diseased, but as bad as it otherwise could be. (6)
Batch of 57 gallons, same flour as No. 6.	18oz., and sugar 12oz.	Straight dough 8.45 p.m., flour 48°, water 102°, when finished 77°, cut back 6 a.m., scaled 7.30, oven closed 8.45 a.m., baked ¾ hour. 3lb. 6oz. salt.	Not so bad as No. 6. Small and close and exceedingly holey. Tight and insufficiently proved, and then a burning oven making it worse. (7)

WARWICKSHIRE METHODS (BIRMINGHAM, ETC.).

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack supers and seconds.	2¼lb. barm, 2oz. distillers, 8lb. fruit.	75° when made (December), sponge 6.30 p.m. till 4.30 a.m. (10 hours).	Flavour worst point, unhealthy smell, dull crust. The barm is brewers' "thick" yeast, weighed instead of measured. Loaf below average. (1)
5 bushels Plain Tie and 2 bushels Amer. supers.	12oz., and 1lb. malt extract.	Dough straight off at 7.30 p.m., water 70°, flour 74° (August), cut back 5.30, out of trough 6.30, oven filled 8 a.m., baked 430°, yielded 140 quarterns (100 to sack). 4¾lb. salt.	Cottage above average, but pinched and undeveloped. More yeast and less time in trough and more after throwing out. (2)
224lb. well-known good brand (English).	12oz.	Sponge 9 p.m., dough 6 a.m., baked 8.30. 2lb. salt.	Excellent all-round cottage (90 marks), well balanced but better if worked quicker. (3)
Country flour, 21s. 3d. per 280lb. (No. 1 London households, 21s. 3d.).	10oz., and 2 pints barm.	Sponge 5 p.m. with 12 gallons 70°, dough 9.45 a.m. with 18 gallons at 80°, cut back 11, in oven 1 p.m. at 475°, bakehouse 70°, batch 207 quarterns. 7lb. salt (March).	Very poor, dark, holey, bad flavour—one of the worst seen for long time. A 17 hours' sponge, and no salt—55 marks at most. (4)
4 bushel sack Exhibition flour.	1½lb.	Straight dough 7.30, cut back 9.30, weighed 10.30, in oven 11.50 for ¾ hour, water about 100°. (July.)	Good cottage as regards flour and fermentation, but not perfectly finished. Set more crusty; prove in drawers, and longer; top and bash, then prove. (5)

WARWICKSHIRE METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
About $\frac{1}{3}$ sack.	$1\frac{1}{2}$oz., and sugar 2oz.	Straight dough 9 p.m., cut back 4 a.m., out of trough 5, in oven 7, baked 50 minutes, 1 bucket (20 quarts) water at 90°, bakehouse 67°. 12oz. salt (August).	Good commercial cottage loaf, but somewhat close for some in crumb—81 marks. Hole from bashing. (6)
84lb. local flour.	6oz., and malt extract 4oz.	Straight dough 6.30, turn 8.30, thrown out 9.30, in oven 11.40 for $\frac{3}{4}$ hour, water 78°, bakehouse 73°. 1lb. salt (August).	Hard cord across centre, through not topping when moulding and getting skin on pieces. Bad work. (7)
Batch of 85 quarterns.	$2\frac{1}{2}$lb. to 4 bushel sack.	Yeast, with half the water and handful of sugar, stirred into thin batter at 6.15; when broken through, dough made, and stood hour; scaled at 2lb. 4oz., oven closed 9.45. 3lb. salt (October).	An unusual shape. A cottage baked in a twopenny tin. Average loaf. More time wanted in trough and afterwards. (8)
35lb.	6oz., and sugar 2oz.	Straight dough about 4 hours start to oven, 3 gallons water, $\frac{1}{2}$lb. flour scalded in quart boiling water, yeast and sugar dissolved in quart at 84°, balance added at 96°, dough when made 84°, made 8.30 a.m., knocked up 10, again 11, scaled 11.30, handed, moulded into tins at 12, proved 40 minutes, covered with damp cloth, baked 50 minutes in hot oven with other bread, and cooled rapidly. $6\frac{1}{2}$oz. salt.	An exhibition method which succeeded. (9)

WILTSHIRE AND BERKSHIRE METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 bushel Amer. pats., 1 bushel country whites.	12oz., and 3oz. extract.	Off-hand dough, in oven 5 hours start to finish. 1lb. salt.	Very good tin—87 marks. (1)
$\frac{1}{3}$ sack (about).	3oz.	Sponge 5 hours, 8 quarts water 100°, dough 5 hours to oven, 8 quarts 70°. 13oz. salt.	A successful small batch. Better loaf than some from better flour—85 marks. Texture and volume good, colour worst point. (2)
Half supers 22s., part fines 20s., part Amer. 20s. (No. 1 households 21s.).	14oz. and 8oz. malt extract.	Batter sponge for half hour, dough, water 95°, for 4 hours, total time $6\frac{1}{2}$ hours. 4lb. salt. (Sept.).	65 marks. (3)
7 stones Amer. spring pats., 3 stones Amer. bakers, and 10 stones English.	9 oz., and 7lb. fruit.	Ferment at 88° for 45 minutes, dough 7 hours with water 60°, cut back, handed up twice, start to finish 12 hours, bakehouse and flour 70°. 3lb. 6oz. salt (September).	Good normal loaf—73 marks. Baking best, texture worst, dough too sluggish and cold, especially for handing up twice. (4)
About 2 bushels.	12 oz., and malt extract 4oz.	Straight dough, water 100°, in oven $3\frac{1}{2}$ hours after dough made. 20oz. salt (March).	Excellent—90 marks. Rather too solid and close for a normal cottage. (5)

WILTSHIRE AND BERKSHIRE METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
125lb. flour (100 country and 25 Amer. bakers).	5oz., and 6oz. sugar.	Straight dough 8.30 p.m., with $6\frac{1}{4}$ gallons water, cut back 5.30, in oven 8.45. 1lb. 9oz. salt (June).	Fair cottage of country type—69 marks. No extremes. Red and tough and unripe. Coarse flour (in spite of name), therefore more heat and yeast and shorter process. (6)
About $\frac{1}{2}$ sack (town supers and town whites).	12oz., and malt extract 10oz.	Straight dough, finished making 8, cut back 8.30, again 9.30, thrown out 11, finished scaling 12.5, in oven 1.20, baked $\frac{3}{4}$ hour, water 32 quarts at 90°, flour 76°, bakehouse 72°. 28oz. salt (June).	Excellent good class cottage. Few holes from insufficient proving after moulding and heavy bashing. Does not want time after throwing out before scaling. (7)
145lb. flour (100 local).	12oz., and sugar 8oz.	Straight dough commenced 5.30 a.m., cut back 7 and 7.45, handed up twice, and in oven 12.20, water $7\frac{1}{4}$ gallons, 120°. $1\frac{1}{4}$lb. salt (July).	Better than No. 6, but have rather overshot the mark in heat for the flour and season. Little over-ripe. (8)
Local flour ($4\frac{1}{2}$ bushels).	4oz., and fruit 1 gallon.	Straight dough 7.30 p.m., chill taken off liquor, thrown out 6 a.m., in oven 8.30, out 9.30 a.m., wood oven. 2lb. salt (July).	Don't copy it. Very poor indeed everywhere. Tight, solid lump. All the usual faults. (9)
3 to 4 bushels country seconds and Amer.	5oz. to sack, and 2lb. liquid brewers.	Tight sponge with half water at 88° for 10 hours, dough, water 98°, 2 cuts back and rise $1\frac{1}{2}$ to 2 hours, no handing up, baked 50 minutes for crusty and 60 for crumby. $3\frac{3}{4}$lb. salt per sack	Average country loaf for flour. Has large hole just above bottom crust because of extra hot sole affecting bad moulders closing. Should be handed up. (10)
300lb. fines, 45lb. supers, 25lb. Amer. pat.	$2\frac{1}{4}$lb., and 8lb. fruit.	Dough straight off with liquor at 90°, 2 hours trough, 3 hours altogether. 4lb. salt.	Good cottage, better than one immediately above. Volume and shape worst points. (11)
$17\frac{1}{2}$lb. home-milled pats.	3oz., and malt extract 1oz.	Straight dough 6 a.m., flour 72° F., 1 gallon water 92°, cut back twice, in oven 11 a.m., time 5 hours to oven. 4oz. salt (September).	A very good commercial loaf from an uncommercially small batch. (12)
1 sack made 100 quarterns.	$1\frac{1}{4}$lb., and food 1lb.	Flying sponge with water 110° for 2 hours, flour 70°, dough rise 1 hour, into oven at 450°, in 4 hours from start. $3\frac{1}{2}$lb. salt (October).	A cottage and tin loaf of medium quality. Cottage, although apparently off same dough, is better colour and better flavour although has more other faults. (13)

WORCESTERSHIRE METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack (supers and Leather Tic).	$1\frac{1}{2}$lb. and 1lb. malt extract.	Dough straight off with water 100° at 6 a.m., in oven at 10 a.m., baked at 425°. 3lb. salt.	Above average cottage. Bright short crust. Firm, close, and short crumb. Nice eating. (1)
	7oz.	Sponge 8.30, water 80°, dough 5.30 a.m. at 85°, in oven 8.30 for 1 hour. 2lb. salt (September).	Very poor. Exhausted. Holes in spite of cold oven. Very sluggish in dough. (2)

Worcestershire Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
$8\frac{1}{2}$ bushels (extras).	$3\frac{1}{2}$lb., and food $1\frac{3}{4}$lb.	Straight dough, in oven from start in $4\frac{1}{4}$ hours, baked 40 minutes, flour 65°, water 110°, dough when made 87°. $5\frac{1}{2}$lb. salt (October).	Good material badly handled. Tight, bound, dry, crumbly, holey. Too little water, too little proof in loaf, but too much changed before. (3)
About $\frac{1}{6}$ sack.	3oz.	Sponge 4 quarts water at 100° at 8 p.m., dough 7 a.m. with 6 quarts water 115°, cut back 8, thrown out 8.30, in oven 10.30, bakehouse 65°, flour 60° (Nov.). $8\frac{1}{2}$oz. salt ($\frac{1}{5}$ in sponge).	Good ordinary loaf for daily commerce. (4)
10 bushels country pats.	$3\frac{1}{4}$lb.	Straight dough, start to finish $6\frac{1}{2}$ hours, baked 40 minutes in side flue oven, water 92°, bakehouse 68°. $6\frac{1}{4}$lb. salt (December).	Very good colour. Distinctive character, small, close, sweet, short and nice. "Like mother made." (5)
112lb. local fines.	$1\frac{3}{4}$lb.	Straight dough 6.30 a.m., water 100°, scale off 9.15, in oven 10.30 a.m., baked 1 hour. $1\frac{1}{2}$lb. salt (January).	On the whole very poor indeed. Colour fair, flavour all right, but general finish bad. Top crust boiled, bottom burnt. Skinny. (6)
110 quarterns from fines, straights and supers.	$3\frac{1}{2}$ pints brewers, and 2oz. distillers.	Sponged at 71° at 6 p.m., doughed at 83° at 6 a.m., thrown out 8 a.m., weighed and handed up 8.40, moulded and in oven 9.35 a.m., drawn 10.35, bakehouse 70°. $3\frac{1}{2}$lb. salt (October) (1lb. in sponge).	Over-fermented, badly handled and badly finished. Discoloured corners. No bloom, although hot oven sole. (7)

YORKSHIRE METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
Country supers, 21s 3d. per 280lb.	4lb., bread sold 1s. 3d. per dozen wholesale, and 1s. 6d. retail.	Straight off dough, 24 gallons water 120°, made 5.15 a.m., turned 6.45, thrown out 7.10, in oven 8.5, out 8.50, heat 540°. 5lb. salt (February).	Tin and cake loaves, both heavy and coarse texture and no holes. No finishing at final stage. (1)
1 sack.	$1\frac{1}{4}$lb.	Sponge with 12oz. salt, half liquor lukewarm, at 7 p.m., dough 6 a.m., rise $\frac{1}{2}$ hour. $2\frac{1}{2}$lb. salt (May).	Tin with coarse texture and no holes. Dry and crumbly. Too much yeast for 11 hours sponge. (2)
35lb. best Liverpool pats.	3oz., and malt extract 1oz.	Straight dough, flour 80°, water 78°, when finished making 82°, finished kneading 4.45, cut back 6.45, again 7.45, in tins 9, in oven 10.5, baked 45 minutes at 450°, start to finish 6 hours. 7oz. salt (November).	Excellent loaf, worth sending to exhibition—93 marks. Slacker dough and warmer oven better. More yeast, more labour. Will stand more proof. Keep tops moister for bloom. (3)
12 stones local flour.	$1\frac{3}{4}$lb., and malt extract 1lb.	Sponge at 3.30, $5\frac{1}{2}$ gallons water, 5 gallons separated milk, dough 5, tinned 7, oven 7.30, baked 45 minutes at 500°. $2\frac{1}{2}$lb. salt, and 2lb. lard (March).	Good all-round tin loaf—87 points. Well made, well proved, well baked. Hole on top through docking. (4)

Yorkshire Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
10 stones (½ sack) best flour.	1¼lb.	Straight dough with 7 gallons 7.30 a.m., scaled 11, in oven 11.45 for 1 hour at 420°. 1¾lb. salt (Mar.).	Much too tight for a tin. Is close, heavy, and pale-baked, like the housewife's home-baked. (5)
¼ sack, 4 parts York, 1 part Amer. best.	10oz., and malt extract 4oz.	Straight dough 1.30, cut back 3.15, thrown out 3.30, set in oven 6.30, out 7.15, oven 400°, 5 gallons water 110°. 1lb. salt (August).	Time too much for yeast and heat. Over-fermentation and cold oven has caused crumbliness. Slack baked, pale and uninviting bread; seems very general in this county. (6)
1 sack.	2½lb.	Sponge 30 minutes, dough 1 hour, baked 35 minutes at 500°. (August.)	Nice fermentation. Crust leathery through insufficiency of change and moisture not driven out in oven—the reverse of No. 6. (7
1 sack (British and Austrian pats.).	2¼lb., and malt extract 6oz.	Straight dough, machine made, water 110°, in machine 8.30 p.m., dough in trough 8.55, on table 10.30, scaled off, let stand 10 minutes and tinned, in oven 12.50, out of oven 1.25 p.m., heat 530°. 3lb. salt (May) and lard ¾lb.	Overworked and crumbly. Crust breaking away; brightness gone—80 marks out of 100. Good flour. The Yorkshire class at the exhibitions has usually been very poor as a whole, as judged by usual standards, probably due to large amount of home baking there. (8)
126lb. exhibition.	18oz., and malt extract 4oz.	Straight dough to oven closing 4½ hours, trough to oven 65 minutes, baked ¾ hour, oven 525°, machine 15 minutes, and 3 cuts back, scaled and moulded direct to tins in 15 minutes after throwing out, 16 gallons water to sack, 86° when made. 27oz. salt.	Excellent exhibition tin (9)

SCOTTISH METHODS.

Flour, Barm, Salt, &c.	Sponge.	Dough.	Information, &c.
Minnesotas, then Top Winters and Minn., yeast, 2 oz. distillers', and 12 gills compound barm.	Quarter with 4 pints at 82° at 4 p.m. Stirred at 5 a.m. with 32 pints at 90°. Sept.	At 6.30 a.m., with 2 pints cold, till 8 a.m.; in drawers till 9, in oven 9.45.	Good loaf. Scotch pint is (usually) half a gallon. (1)
Yeast 5oz., salt 8lb.	Ferment at 80°, with 4lb. fruit, 4lb. flour, 3 pints water; stand 3½ hours. Half sponge 4 p.m., 35 pints at 80°.	Dough 5 a.m., with 25 pints.	Good plain loaf. Price per pound in Glasgow is about half of that in the United States. (2)
Parisian barm.	Ferment 8 a.m., sponge 3.30 p.m.	Dough 4 a.m.; in oven 7.30 a.m., baked 1½ and 1¾ hours.	Better loaves than No. 2, but dough less ripe than usual. (3)
Millers Whites and Spring American Pat., Parisian barm 4½ pints, salt 5½lbs.	Set at 12.30 at 94° for 16 hours, half inch drop; 23 pints.	Dough 19 pints, bakehouse 56°. March.	83 points. (4)

Scottish Methods—continued.

Flour, Barm, Salt, &c.	Sponge.	Dough.	Information, &c.
One sack American, yeast $1\frac{3}{4}$ lb., malt ext. 12oz., salt 3lb.	Bakehouse 68°, May; water 112° F.	Straight dough, 2 hours, cut back, then $\frac{3}{4}$ hour.	Fairly good sandwich loaf—75 marks. Very fully proved in tin. (5)
One sack, yeast 8oz., salt $4\frac{1}{2}$lb. (2lb. in sponge).	Half sponge 5 p.m. for 12 hours. Liquor 72°, July; when set 70°.	Dough liquor 4° hotter, $1\frac{1}{2}$ hours, brake and stand another $\frac{1}{2}$ hour, drawn 11 a.m.	Several excellent loaves from this. (See No. 21 and following.) (6)
About $1\frac{1}{4}$ sacks, yeast 4oz., salt 9lb. 2oz. bakehouse 72°. Aug.	Quarter sponged 5.30 p.m. with 4 gals. 70°, and 10 oz. salt. Sponged 6.30 a.m. with 15 gals. at 96°, and 3lb. salt.	Dough 8 a.m., with 1 gal. at 90°, and $5\frac{1}{2}$lb. salt; trough 1 hour, oven at 12.20 till 2.20 a.m., scaled $1\frac{3}{4}$ lb. (21 hours).	Good colour, pile and volume. Flavour poor to most. Marks—79. (7)
1oz. yeast to each pint.	Quarter sponge with $\frac{1}{3}$ at 5 p.m. Sponge 5 a.m. August.	In oven 9 a.m.; night heat 68°, morning 70°.	Good loaf—81 marks. Better than No. 7. (8)
Best Vienna, local whites and American Pat., Parisian barm.	Half sponge 3 p.m. 72°, bakehouse 76°. Sept.	Dough 5 a.m. at 74°, scaled and rolled up at 6.15; in oven 8.15 for $1\frac{1}{2}$ hours.	Excellent loaf—87 marks. Flavour good, also pile and volume. (9)
Millers' Whites and American pat., Parisian barm 5 pints, salt 6lbs.	Sponge 14 hours, 26 pints and 22 in morning. Oct.		Excellent—92 marks. Good flavour, good pile, &c. (10)
Batch of 174 quartern loaves, sponged with millers' extras and Winter pat., and doughed with millers' whites, Hungarian and Winter pat., 4 pints Parisian, 1 oz. salt to each loaf (4lb.).	Quarter at 3 p.m., water 100°, taken 5 a.m., sponged 90°. 3 pints cold water given to sponge before doughing. March.	Doughed 7.30 a.m., cut back 8, head up 8.30; in oven 10.30, loaf weighs 4lb. Scotch pint weighs 5lb.	Below the Scotch average, being dry, coarse, and holey. Sponges want the strong flour and doughs the weak. (11)
Batch of 240 (2lb.) loaves, 8lb. salt per sack, 3 pints Parisian barm.	Quarter sponge 11 a.m., $6\frac{1}{2}$ pints water 110°, and 8oz. salt, stirred 1.30 a.m., with 16 gals. 110°, salt $2\frac{3}{4}$lb. March.	Doughed 3.30 a.m., $1\frac{1}{2}$ gals. water, and $7\frac{1}{4}$lb. salt; scaled 5.30, in oven at 7 a.m. for 2 hours.	Good, normal, all round quality. Salt, even for Scotch. (12)
10oz. distillers' yeast, salt 10oz. + 2lb. 2oz. + 4lb. 14oz. at the three respective stages.	Quarter sponge, $6\frac{1}{2}$ pints at 70° at 3.30 p.m. Next morning (4 a.m.) $14\frac{1}{2}$ gals. at 100° for $1\frac{3}{4}$ hours.	Dough, 2 gals., 70° (after made), rise 1 hour. Hand made. April.	Normal all round quality, not so good as No. 14 following. (13)
Batch of 288 loaves (2lb.), 7oz. distillers' yeast, salt 12oz. + $2\frac{3}{4}$ lb. + $7\frac{1}{2}$lb. at three stages, malt extract 8oz.	Sponged (quarter) 5 p.m., water 90°, stirred 1 a.m., 18 gals. 100°. April.	Doughed 2.30 a.m., 2 gals. cold; weighed at 4.30, in oven 6.30, baked 2 hours. Hand made.	Distillers' yeast, and quicker methods certain to become more popular. (14)

Scottish Methods—continued.

Flour, Barm, Salt, &c.	Sponge.	Dough.	Information, &c.
Batch of 288 loaves (2lb.), 6oz. distillers' yeast, salt 40oz. + $7\frac{1}{2}$lb.	Quarter sponge 2 p.m., 24 pints water 78°, bakehouse 68°, sponged 4 a.m., 6oz. malt ext., 24 pints 80°.	Dough 2 hours; in oven 8.30, drawn 10.30. June.	Typical good Scotch loaf—West Coast crust. (15)
Yeast 5oz. to 6oz., 1lb. salt at night and 6lb. in morning.	Half sponge 4.30 p.m., with water 76°. Sept.	Dough 5 a.m., 1 hour in oven 8.30; water all cold.	High loaf, dark, coarse, flavour not to our liking. (16)
7oz. distillers' yeast, salt 1lb. + $3\frac{1}{2}$lb	Half sponge 5.30 p.m., 16 pints water 78°. Oct.	Dough at 6 a.m., 16 pints all cold (about 54°), out of oven 10.15 a.m. Machine made.	Plain loaf, good average, nicer flavour than most. The pan is tightened up, and has lard added, is the better loaf and very nice. (17)
Batch of 230 quarterns, 14oz. distillers' yeast, salt $3\frac{1}{2}$lb. in sponge and $10\frac{1}{2}$ in dough	Ferment with 7lb. fruit, 5lb. flour, 14 pints (Scotch) water 90°, when finished, stand 4 hours; sponge 4 p.m. with 36 pints, heat all over 68°.	Dough 6 a.m., with 22 pints at 60°; in oven 8.30 for $1\frac{1}{2}$ hours. Nov.	Very holey and uneven texture for Scotland. Cones and dust clearly seen inside holes. More care wanted in dough stage. (18)
Quartered with Minnesota pats., and stirred and doughed with millers' whites. Parisian barm and 5oz. salt to gallon.	Quarter sponge 12 hours, and $1\frac{1}{2}$ hours in sponge in morning. Jan.	One hour in dough, being $4\frac{1}{2}$ hours from start in morning till oven door closed.	Many good points—85 marks. Flavour worth most, and texture least, being unusually holey. (19)
Sponged with Minnesota pat., and doughed with same and Winters, yeast 6oz. to sack (280lb.), and salt $6\frac{1}{2}$lb.	Quarter sponge 5 p.m. Sunday, half sponge 7 a.m. Monday. Total of 15 gals. water yielded 97 quarterns at 4lb. 6oz.	Doughed 8.15 a.m., in oven 10.30 a.m. ($17\frac{1}{2}$ hours after quartering). Feb.	Good all-round well balanced—83 points. Sponge is mature, but dough barely. (20)
Sponged with Minnesota firsts, and doughed with Spring and Winter, 8oz. of yeast.	Half sponge 5 p.m., with 8 gals. at 100°, and $2\frac{3}{4}$ lb. salt. (Total 16 gals. water, to one sack.)	Doughed 5 a.m., with 8 gals. at 100°, and $2\frac{3}{4}$lb. salt; in oven 9.30 a.m. March.	Excellent loaf—94 marks. Thoroughly Scotch. From same as No. 20. Rather improved if little younger. (21)
Batch of 184 quarterns, 8oz. distillers' yeast, 1lb. salt in sponge, and 5lb. dough.	Half sponge at 4 p.m., heat 84°. March.	Dough 5 a.m., water 114°; in oven 8 a.m.	Very similar to No. 23, but from different localities. Excellent, worth 90 marks. Very ripe. Good pile. (22)
8oz. distillers' yeast, salt $1\frac{1}{2}$lb., then 6lb. American Spring and local pats., then Minn. and local pat. and Hungarian.	Half sponge 4 p.m., 12 gals. water 86°, bakehouse 76°. (Same date as No. 22.)	Dough 5 a.m., 10 gals. water 96°; in oven at 8, drawn 10 a.m.	Better in flavour than No. 22, but not so well finished—88 marks. Being also worse in colour and volume. Could do with more ripeness. (23)
One sack ($\frac{1}{3}$ straight and $\frac{2}{3}$ pats.), yeast $8\frac{1}{2}$oz., salt 17oz. + 4lb. 7oz.	Stirred 4 p.m. with $8\frac{1}{2}$ gals. water at 72°. May.	Dough 5 a.m., $7\frac{1}{2}$ gals. at 86°; in oven 8 a.m.	Excellent—94 marks, better than No. 22, from same man. Few holes, from dry flour inside. (24)
Batch of 143 loaves, whites and extras flour, yeast 12oz., and 6lb. salt.	Sponge 12 hours, set at 70°. Aug.	Doughed 7, 60°.	Typical Scotch, of good average quality. (25)

Scottish Methods—continued.

Flour, Barm, Salt, &c.	Sponge.	Dough.	Information, &c.
Special town millers' pat., then top Hungarian and top Winters, yeast 8oz., salt 7oz. + $2\frac{1}{2}$lb. + $4\frac{1}{2}$lb.	Quarter sponge 2.30 p.m., 7 pints 80°, full height at 9 p.m., and dropped 3 inches at 4 a.m., then sponged, 26 pints at 82°. Oct.	Dough 5.45 a.m., 3 pints at 90°, and 1lb. malt ext.; in trough till 7 a.m., out of boards 8 a.m., braked, chaffed; in oven 9.15, out 10.45 a.m.	Beautiful bread, but rather looser in crumb than normal, being little overproved between the boards. Very big loaf. (26)
American and then Canadian pats. yeast 1lb., salt 5lb. in dough.	Sponged 5 a.m., 24 Scotch pints at 90°, 10 stones flour. March.	Dough 9 a.m., with 8 pints; in oven 11 till 1 p.m.	Ordinary all-round medium quality. Skin and hard line in centre. "On English system." (27)
Half American pats. and half Hungarian yeast 8oz., and salt 8oz.	Straight dough. March.	Dough 4 pints (2 gals.), at 112°.	Said to be "English" bread, but is a bad specimen of the real article. (28)
Local pat., then American, Parisian barm.	Quarter sponge, 12 hours at 96°, sponge $1\frac{1}{2}$ hours at 108°.	Dough as usual. March.	Well made, well finished everywhere. (29)
Batch of 225 quarterns, Edinburgh whites then Minn., first pat., yeast 13oz., salt $2\frac{1}{2}$lb. + $9\frac{1}{2}$lb. in dough.	Half sponge 39 pints water at 90° at 3.30 p.m. Bakehouse 60° April; machine made.	Dough at 4 a.m., with 37 pints at 96°, and $1\frac{1}{2}$lb. malt ext.; in oven 8 a.m.	Good bread, good enough for everyday trade. Pile and sheen beautiful. Nice to eat. (30)
Minnesota first pat. then Home and Vienna, salt 3oz. + 8oz. + 2lb. 3oz.	Quarter sponge, $2\frac{1}{2}$ pints water at 106° at 2.30 p.m., 4oz. malt ext. Stirred 4.30 a.m. with 10 pints at 110°. May.	Doughed 1 pint cold, yielded 7 dozen loaves; in oven 9.30 a.m., lay open $\frac{3}{4}$ hour, closed tight, and drawn at 11.15.	Excellent commercial plain loaf. Little overwrought. (31)
Batch of 334 quarterns, 73 $3\frac{1}{2}$lb. loaves, yeast $1\frac{3}{4}$lb., salt $3\frac{1}{2}$lb. + 17lb.	Half sponge 12 hours, 56 pints at 74°. May.	Dough 64 pints 70°, from dough to oven $2\frac{1}{2}$ hours.	Good commercial, but arriving at same time as No. 31, is seen to be not so good on the whole—not so good in colour or texture. (32)
1 sack medium strength (8oz. 4lb.), yeast 2lb., salt 7lb., malt extract 12oz.		Straight dough, 32 pints water 110°, or such as to make 84° or 86° when mixed. Two hours, turn, then another hour. Hand up twice. Bake 2 hours.	Recommended by a writer in "B.B." Correspondence column, for Scotch squares. Is sweeter. Wants plenty labour. (33)
Half sack millers' whites, yeast $1\frac{1}{4}$lb., salt $1\frac{3}{4}$lb., malt extract 8oz.	(May.) Flour 56°.	Straight dough, 16 pints at 108°. Made 10.30 a.m., cut back 11.45, scaled 1 p.m., in oven 2.30.	Said by correspondent to be copied from No. 33. The worst loaf undoubtedly we have ever seen from Scotland. Much underworked—plain. (34)

SCOTTISH METHODS—(continued).

FLOUR, BARM, SALT, &c.	SPONGE.	DOUGH.	INFORMATION, &c.
Millers' whites, yeast 14oz., salt $2\frac{3}{4}$lb. + $10\frac{1}{2}$lb., and malt extract 12oz.	Half sponge 3 p.m., with 42 pints 78°, flour 58°, heat when set 72°. (May.)	At 4.15 a.m., with 28 pints at 82° (when made 72°). In oven 8.30 a.m.	From same man as No. 34. Fair average plain loaf, nothing to complain of. (35)
28lb. flour, 6oz. yeast, 2oz. sugar, 6 or 7 oz. salt.	(For sack use 2lb. yeast, and 35 pints water for pans.)	Straight dough, $3\frac{1}{2}$ pints water at 100° (about 84° when made). Two hours, knead, then another hour, knead, then another $\frac{1}{2}$ hour. Five hours' start to oven.	Trial batch recommended by Vass. (36)

IRISH METHODS.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack (280lb.) ($\frac{1}{2}$ best local, $\frac{1}{2}$ Amer. spring).	10oz.	Straight dough, 8 hours trough, cut back half time, 14 gals. water 90°, so as to be 75° when finished making, flour 60°, bakery 60°; if wanted lighter give another hour. $3\frac{1}{2}$lb. salt.	This was found better than the 10, 12, and 14 hour sponges previously adopted. Quicker can be given when men used to it. There is often more yield in North Ireland, but now usually sweeter in the South. (1)
1 sack.	$1\frac{3}{4}$lb., and malt extract 1lb.	Straight dough, $13\frac{1}{2}$ gals. at 100°, 2 hours in trough, cut back at $1\frac{1}{2}$ hours, total time $4\frac{1}{4}$ hours. $3\frac{1}{4}$lb. salt.	A most excellent "turnover" in all respects. (2)
1 sack.	$1\frac{3}{4}$lb., and sugar 8oz., and malt extract 8oz.	Straight dough, water 95°, start to finish $5\frac{1}{2}$ hours. 3lb. salt.	Same shape and similar to No. 2, but not nearly so good. (3)
1 sack (local).	4 gals. barm, 2lb. or 3lb. flour, and $\frac{3}{4}$ stone fruit.	Barm made from 8oz. hops, 6lb. malt to 30 gals. water, stocked with 2 gals. old barm, ready in 36 hours, store set at 12 Sunday at 76°, sponge 8.30 p.m. at 84°; dough on Monday at 6 a.m. at 80°, rise $1\frac{1}{2}$ hours, in oven 11, out 12.15, start to finish (excluding 36 hours for barm) 24 hours, in cold weather extended to 31 hours. $3\frac{1}{2}$lb. salt.	Good average loaf, worth 79 marks, texture and volume being best. A tedious system, giving bread no better than with much less labour. Loaf similar to Scotch, but not so well finished as usual there, and this applies to a very large amount of long process Irish bread. (4)
1 sack ($\frac{1}{2}$ first Minn. pats., and $\frac{1}{2}$ first winter pats.).	3lb.	Straight dough, water 90°, when made 84°, turned twice, and in oven in 7 hours after leaving machine. 7lb. salt (February).	Very good batch loaf, 89 or 90 marks. Loses marks in merely subsidiary points, or would be excellent. Flavour good, except rather too salt. (5)

IRISH METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 sack, $\frac{1}{3}$ Amer. bakers', $\frac{2}{3}$ Liverpool pats.	$2\frac{1}{2}$lb.	Straight, start to finish $5\frac{1}{2}$ hours, baked 50 minutes at 450°, one cut back, in tin 1 hour, water 80–90°. 4lb. salt.	A good pan loaf. (6)
1 sack, $\frac{1}{2}$ first Minn. pats. and $\frac{1}{2}$ Hungarian.	$2\frac{1}{2}$lb., and 2lb. malt extract.	Straight dough, 13 gals., water at 110°, rise $2\frac{1}{2}$ hours, knock up and brake, rise another hour, throw out, and brake again, hand up, prove 40 minutes, mould, baked 2 hours, machine to oven $4\frac{1}{2}$ hours. 4lb. salt (Feb.).	Good loaf, but too much malt extract. Belfast is said to be happy medium between Scotch and London. (7)
American spring patent in sponge, and British Exhibition in dough.	8oz. local (Belfast) distillers (with a preliminary start), and malt extract 4oz.	Sponge, 3 gallons at 120°, allowed to come half up then gave another $\frac{1}{2}$ gallon water, were beaten as, if beating butter batter. Doughed when on turn with 2 gallons water at 85°. Cut back twice. Sponge stood at 90° and dough at 86°. Seven hours start to finish. Scotch oven. Hand set sponge, machine-made dough. 6oz. salt (May) in sponge and $1\frac{1}{2}$lb. in dough.	Second prize in "B.B." Competition; an excellent batch (square) loaf; first in its own class; texture soft and springy. (8)
1 sack ($\frac{1}{2}$ first spring pats. and $\frac{1}{2}$ winter).	$2\frac{1}{2}$lb.	Straight dough, 15 gals. water at 72°, bakehouse 80°, turned twice, and in oven 9 hours after leaving machine. 6lb. salt (May).	About same on whole as No. 5, from same man, more bulky; wants more labour for finer texture; square batch (North Ireland). (9)
	$2\frac{1}{2}$lb., and sugar 1lb.	Short sponge, 12 gals. water at 110° at 6 a.m., doughed 9.30 a.m. with 17 gals. at 94°. Started to scale 11.10, in oven 1.15 p.m. 9lb. salt (May).	His usual method is 18 hours sponge and 2 hours in dough with 4oz. total yeast to sack; good batch loaf, similar to numbers 5 and 9, but not so good. (10)
1 sack.	1lb., and malt extract 1lb.	Straight dough, $14\frac{1}{2}$ gals. at 78°, 10 hours, cut back, and well kneaded, given another half-hour. $3\frac{1}{2}$lb. salt.	Good, straight dough being very successful; sweeter with very little loss in appearance. (11)
28lb. (1-10 sack) $\frac{1}{2}$ spring $\frac{1}{2}$ winter.	8oz.	Straight dough, $1\frac{1}{2}$ gals. at 120°, bakehouse 70°, flour 50°, out of oven in 5 hours. 8oz. salt.	Good trial batch, six to ten hours in trough for batched bread, with average of about 7 hours is fast gaining ground—no previous stage. (12)
$1\frac{1}{4}$ sacks.	$1\frac{3}{4}$lb.	Straight dough, 8 hours in oven after making, 18 gals. water at 100°, cut back; in machine 15 minutes; baked 1 hour. 4lb. salt.	Good turnover, and much better than one from 12 hours sponge previously sent; has been well pleased with change for year or so; this is slightly over-fermented. (13)
1 sack ($\frac{1}{2}$ 1st Amer. spring pat., $\frac{1}{4}$ Vienna, $\frac{1}{4}$ winter pat.)	8oz.	Half sponge 16 hours, dough 65° to 70°, rise 2 hours, hand up, prove 1 hour; machine (5 minutes) to oven $3\frac{1}{2}$ hours, baked 2 hours. 4lb. salt (August).	Good commercial loaf; 83 points. North Ireland. The large factories here, as elsewhere, are the slowest in changing to straight doughs. (14)
1 sack.	8oz.	Half sponge 13 hours, $13\frac{1}{2}$ gallons water, dough $1\frac{1}{2}$ hours, dough to oven 4 hours. 3lb. salt.	Well manufactured and well finished, but twangy in flavour; West Ireland. (15)

Irish Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack.	8oz.	Half sponge 12 hours set at 80°; 5 hours on hand in morning. 3lb. salt (February).	Average West of Ireland loaf, but big hole from excessive bashing and non-recovery after. (16)
Exhibition flour, 14lb.	4oz., and malt extract 1oz., and sugar 2oz.	Ferment with 2lb. flour and 1 gallon water at 100°, and all ingredients excepting salt, ready in 40 minutes; doughed 10.40, cut back 11.40, thrown out 12.40, in oven 1.40, drawn 2.25. $2\frac{1}{2}$oz. salt (February).	Good pan loaf, texture rather too coarse; omit sugar and slightly reduce power of ferment; more labour for finer texture. (17)
$1\frac{1}{2}$ sacks (local).	$2\frac{1}{2}$lb.	Sponge, 4 hours at 105°, and dough $1\frac{1}{2}$ hours at 80°. $4\frac{1}{2}$lb. salt (September).	First prize for batch loaf (South). (18)

WELSH METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
$\frac{1}{2}$ sack.	8oz.	Ten hours sponge with one-tenth liquor at 95° F., steam ovens at 400°, 6oz. butter substitute. $1\frac{1}{2}$lb. salt.	Good loaf—81 points. Tin more spongy than usual from here. Moist; good flavour. Long sponge but small, leaving much sweet flour for dough. (1)
140lb. English.	14oz.	Dough straight off, water 113°, oven closed $4\frac{1}{2}$ hours from start, steam oven at 400°, butter substitute 8oz. $1\frac{3}{4}$lb. salt.	Excellent tin. Beautifully moist and short eating. Keep the weight up for exhibition. In most Exhibition classes fat disqualifies. (2)
$\frac{1}{3}$ sack.	5oz.	Trough $4\frac{1}{2}$ hours, tins 1 hour, baked 55 minutes. 12oz. salt.	Splendid tin—89 marks. Blisters from pressing down crust and excessively hot oven, otherwise marks higher (3)
160 quarterns ($\frac{1}{3}$ extras, $\frac{2}{3}$ Leather Tie).	$2\frac{1}{2}$lb.	Off-hand dough, water 95°, at 6 a.m., taken 7.15, oven door shut 9.25, drawn 10.30. 5lb. salt (Oct.).	Good Coburg loaf (called York loaf by sender)—85 marks. Texture best, baking worst and all others equal. (4)
$1\frac{3}{4}$ sacks.	$1\frac{1}{2}$lb.	Sponge 4 hours at 100°, dough 1 hour at 90°. 6lb. salt (October).	83 marks. Crumb colour best point and volume worst. Undeveloped in dough. (5)
Half sack extras 28s., half sack Leather Tie 25s. 6d. (No. 1 households 21s. 9d.).	$1\frac{1}{2}$lb.	Straight off dough, water 100°, rise $2\frac{1}{2}$ hours, cut back and left 2 hours, in oven 1 hour after, baked 55 minutes. $3\frac{1}{2}$lb. salt (November).	80 marks. Crumb colour and flavour best. Good loaf spoilt by silly tin. At the Exhibitions Welsh is more like the ordinary Provincial than usually expected. (6)
1 bag (140lb.) extras.	11oz.	Doughed 12.40 p.m. (water $2\frac{1}{4}$ pails), cut back 3 p.m., thrown out 3.45, handed up twice, in oven 5.10, drawn 6.5, oven 450° F. $1\frac{3}{4}$ lb. salt (November).	Good commercial quartern tin. Nice crust, nice flavour. Loaf too much projecting out of tin, especially for sandwich purposes. (7)
1 sack at 24s. 6d. (No. 1 London households 21s. 3d.).	2lb.	Straight dough 7 a.m., scaled 10.30, in oven 11.30 a.m., out 12.15, sold at fivepence retail. (March.)	Exactly the same remarks as to No. 7. More proof for ordinary purposes. Flavour and moisture are the Welsh characteristic. (8)

WELSH METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
3¼cwt.	1¼lb.	Straight dough 16½ gallons 80°, at 7.30, examined 11.15, finished 4 (8½ hours). 4lb. salt (July).	Distinctly sour, close, heavy, overworked, and exhausted. Skin everywhere. Coburg and yet holes. (9)
280lb. (1 sack).	8oz., and sugar 1½lb.	Straight dough 11 p.m., start to weigh off at 6 a.m., about 18 gallons water at 70°. 2½lb. salt (August).	A very close cutting tin, well made throughout as far as care goes. Cannot have had 18 gallons in this case. (10)
1 sack.	8oz.	Straight dough, 12 hours start to oven, baked 1 hour at 450°. 3½lb. salt (August).	Good ordinary commercial loaf. Very seldom are slow process loaves found in prize list. (11)
1 sack.	1¾lb., and malt extract.	Straight dough, out of oven in 5½ hours from commencing dough mixing. 3½lb. salt (August).	Nice loaf to eat (cottage), but ungainly. Small, flat, dumpty; head too big. Runny and under-ripe. (12)
	10oz.	Straight dough, start to finish 8 hours, baked ¾ hour at 475°, three turns between times, three lard pails water at 95°. 1¼lb. salt (September).	92 marks. Excellent. Sprung here and there in oven, therefore more steam or more proof before setting. (13)
2 sacks.	2½lb., and moist sugar 1lb.	Straight dough, commenced making 5 a.m., in oven 9.30 (4½ hours), baked 50 minutes, water 100°, flour 60°, dough when made 85°. 6½lb. salt (Oct.).	Ordinary average cottage, but flavour good. Bashed too hard to recover in the time. Welsh usually poor at the shows. (14)
2 sacks, average 22s., bread 4½d.	1lb.	Sponge 12 hours with ⅓ liquor, dough 1¾ hours, baked hour, total time 16 hours. 6lb. salt (April).	Not good—68 marks. Small, close, squatty. Volume worst, flavour best. No holes. Give sponge less fermentation and dough more. (15)
Bushel of flour.	3½oz., and 3oz. malt extract.	Straight dough 7 a.m., cut back 11, in oven 12.30 p.m., water 80°. 12oz. salt.	Good all-round cottage—84 marks. Holes from bashing and underproof. (16)
2 sacks.	2lb., and malt extract 2lb.	Water 90°, time from sponging to baking 7 hours. 6lb. salt (October).	A plain and a tin, both good. Well finished, nicely baked, but bound, tight, and close. (17)
Batch 60 quarterns local superfines bread 5d. (No. 1 London households 24s.).	4oz.	Straight dough 11 p.m., cut back 6 a.m., thrown out 6.30, oven door shut 9 a.m., baked 1 hour. 2lb salt (October).	Flour somewhere over-fermented and loaf underproved. The writer has been on Snowdon in July with 2° of frost. (18)
1¼ sacks local pats.	1lb. 14oz., and malt extract 9oz.	Straight dough 6 a.m., water 112° F., turned 7.30, in oven 11 a.m. at 515° F. for 1 hour. 4lb. salt (May).	Splendid cottage of its type, but distinct. Beautifully smooth and well finished, crust like a biscuit. Well proved, well baked, no holes, and good texture. (19)
140lb. exhibition.	1½lb. (started few minutes), sugar 8oz.	Straight dough, 31 quarts water at 115°, when made 94°, in trough 2 hours, then cut back twice, thrown out at 3½ hours from start, handed up twice, in tin 1 hour, baked ¾ hour at 465°, total time 5½ hours, salt 1½lb. (May).	Makes a splendid slice of bread—like a quartern. Took high place in recent competition. Rather coarse through being, for the temperature, long in tin. See illustrations—the largest tin. Best flour is commercially used in South Wales. (20)
British patents.	1¾lb., and malt extract 12oz.	Straight dough 5 hours from start till out of oven, water 110°, salt 2¼lb. (September).	A prize-winner's method. In Welsh country places mostly large loaves are made, and not much in half-quarterns or cottage and tin; in towns there is more of the latter. (21)

BROWN AND WHOLEMEAL METHODS.

Meal, &c.	Yeast and Food.	Times, Heats, and Systems.	Information and Suggestions.
4lb. meal, and $2\frac{1}{2}$lb. (quart) liquor.	$\frac{1}{2}$oz. (1oz. per quart, if less than 4), and malt extract or sugar 1oz.	To every quart of liquor. Dough straight 2 hours, at 85° when finished making. For change 2oz. per quart of golden syrup can be added in place of malt. $\frac{3}{4}$oz. salt.	A good base to work upon. Third of liquor as milk, and $\frac{1}{2}$oz. butter to quart is good. Mould loosely. Make slacker at first, then tighten and put in tins like a slack tin dough—not tight or sloppy. (1)
90 quarterns.	2lb., and malt extract 1lb.	Straight dough, water 95°, time from mixing meal to finished loaf $5\frac{1}{2}$ hours (out of oven). 3lb. salt (May).	An excellent loaf—90 marks. Nicely baked in oval tin. Crisp crust; smells nice. Straight dough better than dipping out from sponge. (2)
Batch of 9 gallons.	6oz., and sugar 4oz.	Straight dough made 8 a.m., in oven 11 a.m., water 80°, bakehouse 70°. (July.)	Good ordinary loaf, but little close. Too slow proving and baking. For 2lb. an hour at 430° is fully long and cool. (3)
12lb. meal, 2lb. flour.	3oz.	Straight dough, water, and 1 quart milk. 3oz. salt, and lard 4oz.	Medium quality; 1oz. lard to quart liquor is good rubbed into meal. (4)
Batch of 16 quarterns.	6oz., and malt extract 2oz.	Straight dough to oven 3 hours, water 110°. 6oz. salt.	Good, but little coarse. Will drop in centre of loaf if over-proved. (5)
Makes about 17 loaves weighed at 2lb.	7oz., and malt extract 2oz.	Straight dough at 80° when finished making, 6 quarts water, stand 2 to 3 hours. 4oz. salt.	Oval tins or plenty of space in oven and black or ungalvanised are best, so that heat penetrates everywhere quickly, baking evenly. (6)
2 bushels. Meals vary in water-absorbing capacity, even more than white flours.	8oz.	Ferment with half water at 85°, adding good handful of strong flour to the meal, two teacups of golden syrup, stand 2 hours, make dough with water 100° and stand 1 hour, oven door shut in 2 hours from commencing to make dough. small loaves baked in 40 minutes.	Made a batch of good brown bread in all respects. Should be fermented as quickly as possible, not having too much malt extract and water when reaching oven, thereby baking almost as quickly as white tins, and with thin, crisp crust. (7)
Fine meal and no added flour.	4 to 5 oz., and sugar 3oz.	Straight dough with 3 quarts water, make slack, stand 2 hours, tighten up to firmer dough, scale, prove in tins 20 minutes. 3oz. salt.	Meal breads have recently improved, owing to an advance in the quality of meals and the quicker methods of fermentation now employed. (8)
14lb. Hovis.	4oz.	Make slack dough or batter with $10\frac{1}{4}$lb. water and $\frac{2}{3}$ of the meal, then add remainder meal, weigh and tin at once, and prove 20 to 40 minutes.	A good type. Dough should be about 90° to 95° when finished making, but as water to get this would be very hot, some of its heat must be absorbed by the meal before adding yeast. (9)
14lb. meal and 3lb. flour. Oven bottom and cottage browns of course take less liquor than tins.	1oz. yeast to quart of liquor, and sugar 2oz. to quart.	Mix flour and meal, pour in centre 4 quarts liquor ($\frac{1}{4}$ milk) at 105°, add yeast and sugar, then butter and salt, mix slack, tighten in 2 hours and tin at once. Other methods—by adding lard, sugar, &c.—can be suggested for larger quantities. Salt 1oz. to quart, and butter $\frac{1}{2}$oz.	Butter can be added by melting and pouring in with salt. Yeast and sugar can be dissolved after some of the meal has been mixed with water in the centre, and can get a start by leaving as batter, while getting butter and salt ready, &c. (10)

Brown and Wholemeal Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
¼sk. (70lb.) fine meal.		Take 14oz. of bicarbonate of soda, 26oz. cream of tartar, add to meal and well sift the whole, dough to rather soft consistency quickly so as to retain the gas, tin at once, bake in moderate oven. 12oz. salt..	Nice for a change. When using chemicals any escaped gas cannot be replaced, the action being induced by water time for this escape must not then be given. (11)
6lb. meal and 2lb. flour.	2oz.	Slack straight dough, 3½ pints water at 100°, 1 hour trough, prove ½ hour. 2oz. salt.	Very good loaf indeed in all points. If tight, is husky and chaffy ; if too slack will not bake without thick crust. (12)
14lb. meal.	3oz., and malt extract 4oz.	Straight dough, 4 quarts water 120° (March), lard 4oz., trough 1½ hours, including turn over, moulded straight into tins, and proved ½ hour. 3oz. salt.	Good commercial loaf. (13)
4½lb. meal.	1oz.	Straight dough, 3lb. water 112°, heat when made 75°, made 4.15, cut back 5, scaled and moulded 5.15, in oven 6, out 6.55. ¾oz. salt.	Heavy and close. (See No. 1.) (14)
(Same quantity yeast would also make 20 quarterns bread, with 45 minutes in trough.)	8oz., and 8oz. malt extract.	Straight dough, 1 hour trough and ½ hour in tins, water 10 quarts at 90° (September). Salt 8oz.	Very good all round loaf ; ½lb. of yeast would also make up 12 quarts of liquor in 3 hours from start to finish of drawing. (15)
	10oz., and 8oz. malt extract.	Batter sponge, 6 quarts water 90° (September), 1 hour, dough 6 quarts water at 90°, 4oz. butter, 1 hour, in tin 15 minutes, sponge to closing oven door was 3 hours. 4oz. salt.	Good loaf, copied from process of prize winner in "Malted Brown" class. (16)
130lb. meal and 30lb. flour.	2½lb. brown sugar.	Doughed with 2lb. carbonate of soda, 1lb. cream of tartar, 12oz. tartaric acid. 2lb. salt.	A good loaf from Lancashire. We once had a good loaf said to be made rom 2lb. malt extract to 10lb. flour. (17)
14lb. meal and 2lb. flour.	3oz., and malt extract 2oz.	Half milk, half water at 100°, prove 20 minutes in tins. 3½oz. salt.	Called wholemeal by sender, which, with added flour, it cannot be. (18)
7lb. meal, 5lb. flour.	3oz., and malt extract 1lb.	Took 3 quarts water at 160°, the malt extract and half the flour, allowed stand ½ hour, then meal and yeast added, together with 3oz. cream of tartar, 3oz. soda, 4oz. lard, 1 hour trough. 3oz. salt.	A sodden mass—23lb. of malt extract to the sack—made from a recipe recommended to the correspondent in a trade journal. (See above.) (19)

MILK AND VIENNA METHODS.

Flour.	Yeast and Food.	Times, Heats, and Systems.	Information and Suggestions on the Quality.
4lb. to 4½lb. to quart. mixture of half Hungarian, half best British pats. For Vienna twists, etc., more flour is required, more butter or lard, and greater proportion of milk to water.	1oz. to quart up to 3 or 4 quarts, or 6oz. to 10 quarts liquor (1oz. to quart is about 4lb. to sack).	These are quantities per quart of liquor (half milk and half water) for very small batches. Salt ¾oz. to quart. Butter, lard, or other shortening, according to price, 1oz. to 2oz. to the quart is often an improvement, and about seven times the amount for Vienna crescents. Sugar 1oz. to quart, half in the ferment when there is one. Half ounce malt extract can be used in conjunction with ½oz. sugar to quart. Tablespoon, first dipped in water, will hold about 2oz. malt extract.	A good base to work upon. With an ounce of yeast to the quart up to 3 or 4 quarts, and with water at 95° F., the sponge would not hurt and want anything from 45 minutes to 2 or 3 hours, and the dough 30 to 60 minutes. If off-hand dough were made 80° when finished, dough could stand 2 hours, then be again well kneaded, stand another half hour, cut back and then another half hour. Bake in sound oven, not too flash or scorching, and set the loaves or rolls with their top surfaces well moist into an oven full of steam—steam that is "wet," not having become superheated.
8lb. flour.	2oz., and sugar 2oz.	Straight dough, nearly 3½ pints liquor (half milk, half water) at 108°, when made 79°, salt 1¾oz., in trough nearly three hours, including cut back at half time.	Good loaf and good process. Such small quantities want keeping in very warm place—near oven—or made warmer at start in colder weather.
8lb.	2oz., and sugar 2oz.	Ferment with the milk at 95° and yeast, and sugar and about 1lb. flour to the pint, rise and fall in about 45 minutes, dough one hour, 1¾oz. salt, remainder liquor (water) leaving dough 80°.	Improve the surface by moulding without dust, and turn it downwards on cloth when proving; if not injecting steam in oven you might egg wash top before proving.
20lb.	8oz., and malt extract 4oz., and sugar 4oz.	Straight dough, five quarts liquor at 100° (half milk, half water), 1lb. butter, 4oz. salt, in trough three hours.	Good. Process evidently adopted by correspondent from Gribbin's book as published at these offices.
12 stones.	20oz., and sugar 4oz.	Sponge 8.30 a.m., 5 gallons water at 100°, dough made 10 a.m. with 3 gallons separated milk and 2 gallons water at 110°, lard 2½lb., salt 1lb. 14oz., in tins 12, in oven 12.45, baked one hour at 420°.	Good average loaf, but is too crumbly and little coarse, being overproved in tin for cool oven, also baked too long, losing moisture; very light.
4lb. (half best British pats. and winter American pats.).	1oz., and malt extract 1oz.	Straight dough 80° when finished making, 33oz. water 110°, bakehouse 64°, made 4.25, cut back 5.10, scaled 6.10, in oven 7.10, margarine 2oz., salt 1oz. (April).	Small, poor, unready; the opposite of one just preceding; abundant labour is necessary for quality.

Milk and Vienna Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
Half English pats. and supers. Vienna flour is less used for fancy bread than formerly.	10oz., and sugar 5oz.	Straight dough, $3\frac{1}{2}$ hours start to finish, 3 quarts milk, 3 quarts water, 6oz. salt, 12oz. margarine, liquor 80°, cut back $1\frac{1}{4}$ hours, after making, ordinary bread oven, baked half hour.	Nice long roll or stick or yard loaf for flour and oven ; rather over-fermented ; nicely short to eat. Keep covered and moist or else wash with scalded flour when drawing.
140lb.	$1\frac{1}{4}$lb., and malt extract 4oz.	Straight dough with skimmed milk, $1\frac{1}{2}$lb. lard, $1\frac{3}{4}$lb. salt.	Quantities used by a prize-winner. The entries at the shows in Vienna and milk are usually very few.
14 bushels of bread from $\frac{1}{3}$ Minn. pats., $\frac{1}{3}$ town households. $\frac{1}{3}$ town whites.	Four quarts patent yeast in ferment, and 20lb. fruit. In sponge 8oz. distillers'.	Ferment with 6 gallons water and half quartern tin full of flour, with yeast and fruit for 8 hours, sponge with three pails (12 gallons), ready in 2 hours, dough with double quantity of liquor as in sponge, 7lb. salt, rise 2 hours.	Loaf from this gained third prize in fancy bread at London Exhibition.
280lb. best British pats.	3lb. (Overproof prevents rolls breaking out nicely.)	Straight dough, 12 gallons water at 120°, 3 gallons milk, 4lb. lard, $3\frac{1}{2}$lb. salt, in trough 2 hours, baked at 500°.	Excellent commercial loaf, good as need be in all points. Carefully made. Carbonate of soda and borax hides or checks sourness in milk.
140lb. (In a collection of fancy bread recently received from practically every large town on the Continent of Europe, Antwerp was the best.)	$1\frac{3}{4}$lb. (The glazed crust is due to the moisture in conjuncture with heat, making dextrin.)	Sponged at 2.30 a.m., doughed at 3.30, cut over 4 a.m., scaled 4.30, in oven 5.30 a.m., baked 45 minutes, lard 4lb., milk 18 quarts, with water, salt $2\frac{1}{2}$lb.	Good bread, worth 85 marks out of 100. Very fully proved, rather too loose, wants keeping back more by labour for exhibition quality. Milk should add to nutrition, sweetness, and moistness, the important ingredients being the milk, sugar, fat, and albuminoids.

Milk and Vienna Methods—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
(Crust wants well drying in oven or else will lose crispness.)	4oz., and malt extract 1oz.	Quart milk, quart water at 90°, 1lb flour in ferment, drop, dough light with $1\frac{1}{2}$oz. salt, 1 hour, washed with eggs and milk.	A prize-winner's method. (A milk loaf should not be a Sally Lunn or a teacake and sweet, but a quickly fermented light loaf with extra good flour and addition of milk.)
28lb.	4oz., and malt extract 2oz.	Ferment and dough at 80°, 8 hours start to finish, $\frac{1}{2}$lb. lard and butter, $\frac{1}{2}$lb. sugar, 6 quarts milk and water.	A prize-winner's method. Good milk contains 87 per cent. water, about 5 per cent. milk sugar, nearly 4 of fat, $3\frac{1}{2}$ of albuminoids, and the balance mineral matter.
4lb. (half soft).	(Specific gravity of milk is 1027-1032, according to cow. Pint weighs $20\frac{1}{2}$oz. Cream is lighter than skim milk, being about 10 per cent. of whole by measurement).	3oz. cream of tartar, $1\frac{1}{2}$oz. bicarbonate soda, 4oz. lard, 4oz. salt, 1 quart milk, 1oz. sugar, add more milk if for slacker and tin dough, baked at 430°, smaller goods at 460°, stand half hour before putting into oven after shapes made.	Aerated or unfermented milk bread as recommended in British Baker. The aerated bread of some firms is made by forcing in gas as supplied in cylinders from breweries and not by adding chemicals.

AFRICAN, AUSTRALIAN, NEW ZEALAND, GUERNSEY, AMERICAN, CANADIAN, Etc., METHODS.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
1 sack.	2lb., and 8oz. malt extract.	Dough straight off, water 110°, out of oven $4\frac{1}{2}$ hours from start. Salt 3lb.	Good tin for the price. From Guernsey.
$\frac{3}{4}$ sack, half supers, half fines, 20lb. Amer.	12oz., and 12oz. malt extract.	Dough straight off 5.30 a.m., cut back at 9, thrown out 10, set by 11, baked by noon, water 95°, dough when mixed 80°. Salt $2\frac{3}{4}$lb. (Nov.)	73 marks, most for crumb colour, least for texture and holes, others equal. Put in hot oven too soon after moulding. Unready. Guernsey.
Canadian patent, English supers and fines.	1lb., and malt extract 1lb.	Straight dough 4 a.m., water 96°, thrown out 9.30, in oven 10.45 for 1 hour. (April.)	Good ordinary sandwich loaf, nothing to complain of. Guernsey.
$\frac{1}{2}$ sack supers and $\frac{1}{2}$ sack fines.	5oz., and potatoes 5lb.	Sponge 10 hours at 90°, dough 90°, stand one hour, weigh off, and in oven in 2 hours, baked 1 hour.	Poor, holey, pinched. Wants less fermentation in trough, and more in loaf stage. Grey crust. Guernsey.
1 sack (280 lb.).	$1\frac{3}{4}$lb., and sugar 8oz., and malt extract 8oz.	Straight dough, water 95°, start to finish, $5\frac{1}{2}$ hours. Salt 3lb.	Trade increased by this process. Guernsey.

AFRICAN, AUSTRALIAN, NEW ZEALAND, GUERNSEY, AMERICAN, CANADIAN, ETC. METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
1 bag (200 lb.), price (April, 1897) of bread, 3½d. and 4d. per 2lb. loaf.	6 pints home-made or patent. ("Potatoes scarce, dear, and bad.")	Straight dough from following yeast (usually, however, has a ferment), uses ¾lb. hops, 10 gallons water, 1lb. wheatmeal, boils half an hour, boils 24lb. potatoes, mashes with 1½lb. meal, 2 quarts malt, and adds to the above hop infusion, cools to 85° F., adds 7lb. sugar, 4lb. dried flour, ½lb. ground rice, 2 pints old stock.	New Zealand method. Ferment and dough with brewers' yeast is very much employed.
196lb. (one barrel), total solids 218lb. to 178 lb. water, produced 384 lb. bread (96 quarterns).	1½lb., and malt extract 3lb., sugar 3lb., and other food 1½lb.	Straight dough, 4lb. corn meal, 6lb. lard, 3½lb. salt, 178lb. water (June), kneaded in machine for 30 minutes, placed in trough for 2 hours, thrown out, scaled into 337 tin loaves.	From Ontario (Canada). This enormous yield of bread per barrel of 196lb. flour (being as much as produced from a sack of 280lb. in England) was witnessed and sworn and signed before a commissioner by three men (the document being before us) as being correct.
⅓ Spring Amer. First Patent (a mark well-known in London) and ⅔ African.	5 gallons patent. (Loaf is between a London and a Scotch.)	Scald 20lb. flour with liquor in which 2oz. hops boiled, thin down with cold water, add 10lb. mashed potatoes and store, ready 12 hours, make daily, sponge 10 gallons water about 86°, ready 6 hours, lift 18 gallons water about 86°, salt and 2lb. malt flour, cut back in hour, throw out ½ hour after, in oven 1 to 1½ hours after throwing out. (May.)	From Kimberley, Africa. Weather changeable. The general formula away from coast is make yeast from scalded flour, hops, start by old yeast, ready in 24 hours, then potato ferment, ready in 12 hours. Others have sponge and then all night dough.
	3 pints home made.	Sponge without salt 14 hours, then medium stiff dough with 3lb. salt, lie 1½ hours, baked 1¼ hours. (May.)	Guernsey turnover. Huge hole in top. Bad flavour, but musty rather than sour.
	Patent yeast and malt extract.	Sponge 5 hours, salt 3¾lb. to sack. Tin loaf, some others from here have also been tins.	Gibraltar. Loaf just turning mouldy. Small and bound.
(See also article on Yeast.)		30 gallons water, 2¼lb. hops, boil ½ hour, 3lb. meal boiled with the hops, dry in the oven 6lb. meal and 4½lb. flour, one dozen bananas, boiled with 48lb. potatoes and 2¼lb. ground rice; the potatoes, dried meal, flour and ground rice are put together in a tub, and smashed well together, add 2¼lb. malt extract in water at 160°, strain off all together, bring to 93°, and set away with 15lb. crystallised sugar, and stock with 3½ dippers yeast, in 24 hours put in 6lb. salt and a tumbler of brandy, and it is then ready for use.	Australian. Method of yeast-making as sent to "B.B." columns. The brandy helps it to keep. Off-hand dough often used, but sponge and dough in colder weather.

AFRICAN, AUSTRALIAN, NEW ZEALAND, GUERNSEY, AMERICAN, CANADIAN, ETC., METHODS—continued.

FLOUR.	YEAST AND FOOD.	HEATS, TIMES, AND SYSTEMS.	INFORMATION AND SUGGESTIONS ON THE QUALITY.
2 bags (each 200 lb.) yielded 286 loaves of 2lb. (tins).	10 quarts, home made.	Straight dough, flour 80° (Feb.), water 70°, dough when finished 80° F., salt 6lb., finished making dough 10.30 a.m., cut back 5 p.m., thrown out 5.45 p.m., in oven 8.30 for 40 minutes, then start drawing. Flash or furnace oven of ordinary type. Yeast made by boiling 8 gallons water, 8oz. hops and 1lb. bran, for 10 minutes, strain into cask, add 14lb. potatoes, cool to 80° or 82°, set away with 4lb. sugar, 2lb. flour, 1 quart old stock, and when finished working add 1½lb. salt.	From New South Wales (Australia). Climate 65° to 100° in shade in summer. Found ropy bread articles, as sent to another Australian, very valuable. Price in Australia seems to be usually about 6d. to 7d. per 4lb., in Canada 7d., and in Africa 9d. to 10d.; but a client, who called on the writer recently, said when he left Johannesburg (few months after peace proclaimed) he was getting 9d. for 2¼lb., and paying 6d. each for eggs.
(In Africa mostly patent yeast is used, as there are no yeast factories or distillers' yeast, and brewers' is generally not good. Mostly hop and potato yeast with no malt, and ferment and dough.)	(The writer has some very extensive information, which is difficult to focus here for the general reader, concerning colonial and foreign bread-making, which can be supplied on individual application).	Yeast was made from 8 gallons water, 10oz. hops, 3 lb. sugar, 1lb. salt, 5lb. flour, 2lb. crushed malt, 14lb. potatoes, flour, sugar, and salt scalded, and malt washed at 160°; maiden stock, sometimes use ground rice; the yeast found to be best happened to have no malt in it, now uses malt flour; usually made first-class bread, good bulky loaf, with nice rich bloom, good colour and pile, and was so when taken from oven, but in 24 hours was bad and stinking.	From Queensland (Australia). Height of summer (Jan. 10th) then said correspondent. See article on Yeast and also on Ropy Bread. This man first expressed his "doots" concerning our remedy for ropy bread, afterwards wrote to Press, saying we were right, and afterwards called, personally, to profusely thank us for stopping his trouble.
		Brewers' yeast used for bread eaten by English residents and Portuguese upper classes. Lower classes have leaven with large quantities potatoes.	Madeira style. Some hotels have distillers' yeast by fast liners.
	French leaven process—very laborious, very general for household bread in large, flat, long loaves. Other sorts lighter, but tough in crumb.	Take 12lb. very stiff dough left over from yesterday's baking, or dough that has stood 10 hours, work into it an equal quantity of fresh flour and water, allow to stand about 8 hours, work in more flour and water, allow to stand another 3 hours, add 100lb. flour, and half that quantity of water, and about 5oz. brewers' yeast; this finished leaven weighs about 200lb., and is mixed after another 2 hours with 132lb. flour, 7 gallons water, ½lb. yeast, and 2lb. salt; this dough is divided into two, one is scaled and baked, the other half is kneaded with more flour, water, yeast, and salt, and again divided, one part baked, and the other part mixed with more flour, etc., to be again divided; the sub-division is repeated three times, the best bread being in the last batch.	
		6lb. malt, 6lb. sugar, 6lb. flour, 6 gallons water, 1lb. bran, 12lb. potatoes, 4oz. salt, 1oz. tartaric acid.	Tasmania. A spontaneous ferment.

African, Australian, New Zealand, Guernsey, American, Canadian, etc., Methods.—continued.

Flour.	Yeast and Food.	Heats, Times, and Systems.	Information and Suggestions on the Quality.
8 bushels flour.	7oz.	Sponge 3 hours, half total liquor 78°, being same as bakery.	From Canada.
100 quarterns (4lb.).	3 quarts patent, and sugar $1\frac{1}{2}$lb.	Straight dough at 78° when finished making, stand 12 hours, salt $3\frac{1}{2}$lb., lard 1lb., total 17 hours start to finish.	Another Canadian, written by A. E. J., of Winchester, Ontario. Yeast comes from America, and is 14d. to 15d. per lb.
1 barrel (196 lb.). (Trade there largely wholesale to grocers)	$1\frac{1}{2}$lb., and sugar $2\frac{1}{2}$lb. (In New York loaves are usually 1lb. 3oz., sometimes 1lb. 2oz. for 5 cents ($2\frac{1}{2}$d.) (Some top price men get 8 or 10 cents per lb.)	Straight dough, 2 hours, cut back, give another hour, throw out, mould into tins, prove 30 minutes, bake 1 hour at 330°, water and milk $12\frac{1}{2}$ gallons, leaving dough when made about 85°, salt $1\frac{1}{2}$lb., lard $2\frac{1}{2}$lb.	American method See also article on Home-baking —very much more general in the States than here. Most of the bread is in pans and in smaller loaves than here.
200lb. (1 bag).	6 pints home-made as recipe given.	32lb. potatoes (good and sound, not new ones), 10lb. sugar (brown crystals, best), 20oz. hops, $1\frac{1}{2}$lb. bran, 16 gallons water, bring the water to boil, put hops and bran in, let boil 15 to 20 minutes, have potatoes boiled ready for the hops, place the sugar in the yeast tub, mash potatoes, pour hot liquor on into tub, stir sugar well, cool to about 80° in summer and 90° in winter, have 4lb. baked flour and 2 quarts stock to start it with ; ready in about 24 hours, then put 3lb. salt, then ready for use ; the quicker the liquor is cooled the better.	Water 76°, bakehouse 80° (Jan.). Make the dough right away, and it is ready in about 8 hours ; no potatoes used ; if the temperature lowers to about 70°, put 1 pint glucose, and that sends it on ; a cut over in the dough, if it should seem to be very slow, will improve it. Should say that for about 5 hours it lies quite dead. In the winter months, of course, it takes much longer, and hot water used so as to bring it over 80°. From Sydney, New South Wales, Australia. (The above are the remarks of the correspondent.)

SECTION VII

USEFUL DATA

"With all thy getting get understanding."

Proverbs iv. 7

WEIGHTS AND MEASURES

UNDER this heading it is not intended to give fully such tables as may be found in any arithmetic book, or else in the *British Baker* Diary, but, in order to understand fully much of what has been written in the present work, and to more easily make various calculations that one occasionally requires, it will be extremely useful to have set out in a concentrated form some of the leading measures of weight and volume, so that their relation one to the other may be easily seen. It is also imperative that some consideration should be given to the very many different meanings that such simple words as pint, quart, quartern, gallon, bushel, and quarter have in different districts of the country, and even in the same district under different conditions.

The most simple and convenient system of weights and measures is that known as the metric system, and universally adopted on the continent, and if adopted in the United Kingdom the present article would not be needed. The units in this system are the metre, being that of length ; the litre, that of capacity ; and the gram, being that of weight ; and the great advantage is that the unit of weight and capacity are directly connected with one another, the former being exactly a one-thousandth part of the latter. A further advantage is that greater, or smaller denominations are expressed by prefixes, the words kilo, hecto, and deca meaning respectively 1000, 100, and 10; and milli, centi, and deci meaning one-thousandth, hundredth, and tenth; so that in the following list one has only to remove the decimal point to translate one to the other, instead of, in our system, having to multiply a yard by 3 in order to find the number of feet, and a foot by 12 to find the number of inches.

Thus a

Metre = 39.37 inches or 3.28 feet. Mile = 1.6 kilometres.
Kilometre = 39.370 inches = 1093½ yards.
Litre = 1.76 pints = 61.0 cubic inches = 35.2 fluid ozs.
Gram = 15.43 grains, or 0.03527 ozs., or 1 c.c. at 4 degs. C.
Kilogram = 35.27 ozs., or just over 2 lbs. 3¼ ozs. avoirdupois.
Kilogram = 2.20 lbs. avoirdupois or 2.679 lbs. troy.
1000 c.c. = 1000 grams, or 1 litre, or 1¾ pints.
Grain = 0.06479 of a gram.
Ounce = 28.35 grams, or 437.5 grains, or 10 farthings.
Pound = 0.45359 of a kilogram (or kilo).
Cubic inch = 16.38 c.c. (cubic centimetres) or 252.5 grains.
Cubic foot = (12 × 12 × 12) 1728 cubic inches.
Cubic foot of water = 62½ lbs.
Gallon of water = 4541 c.c., or 4.54 litres, or 10 lbs. at 62 degs. F., or 160 ozs., or 70,000 grains, or 277.27 cubic inches.
Gallon of flour = 7 lbs.
Gallon of bread = 8 lbs.
Quart of water = 2½ lbs., or 2 pints, or ¼ gallon.
Quart (Winchester) = about 2 of above quarts (used in laboratories).
Quart loaf = 2 lbs.
Quartern of bread = 4 lbs. 5½ ozs. once legal, according to the Bread Assize.
Quartern ,, = 4 lbs., according to custom.
Quartern of flour = 3½ lbs.
Pint = ½ a quart, or 1¼ lbs., or 20 fluid ozs.
Pint (Scotch) = ½ a gallon or 5 lbs. See below.

	1 sack	of flour	=	1 "sack"	of bread.
Or	5 bushels	,,	or	6 bushels	,,
,,	20 pecks	,,	,,	24 pecks	,,
,,	20 stone	,,	,,	24 stone	,,
,,	40 gallons	,,	,,	48 gallons	,,
,,	80 quarterns or pottles	,,	,,	96 quarterns or pottles	,,
,,	160 quarts or half-qtns.	,,	,,	192 quarts or half-qtns.	,,
,,	280 lbs.	,,	,,	384 lbs. (relatively)	,,

A sack of fruit, vegetables, or coal = 3 bushels (Chaldron = 12 sacks).
,, wheat . . . = 4 bushels.
,, flour . . . = 5 bushels.
,, bread . . . = 6 bushels.
,, bran . . . = 6 bushels.
A large sack (or a poke) of bran = 8 bushels.
Cental = 100 lbs.
Quarter = 2 sacks.
Quarter of wheat = 8 bushels or 480 lbs. (Imperial).
Quarter ,, ,, = 496 lbs. off stands at Mark Lane, or 480 lbs. when sold "to arrive." See below.
Quarter of bran = 16 bushels. Quarter of malt = 336 lbs.
Stone of bread = 16 lbs. or 8 half-quarterns.
Stone of flour = 14 ,, ,, ,,
Barrel ,, ,, = 196 lbs., therefore 10 barrels = 7 sacks.
Sack ,, ,, = usually 5 bushels of 56 lbs., sometimes 4 bushels.
Pack ,, ,, = 240 lbs. (Liverpool).
Bag ,, ,, = 140 lbs. (usually gross weight).
Area of round pipe = diameter × diameter × .7854, therefore 2-inch pipe equals four times the capacity of a 1-inch.
Circumference of round tub = diameter × 3.1416.
To convert barrels into sacks multiply by 10 and divide by 7.
To convert grams to ounces avoirdupois multiply by 20 and divide by 567.

To convert kilograms to pounds multiply by 1000 and divide by 454.
To convert litres to gallons multiply by 22 and divide by 100.
To convert litres to pints multiply by 88 and divide by 50.
To convert millimetres to inches multiply by 10 and divide by 254.
To convert metres to yards multiply by 70 and divide by 64.

When referring above to the pint as adopted in Scotland we have given it as 5 lbs., or four times the amount of the pint understood in most parts of the kingdom, and we have always understood that and that only to be correct. It appears, however, according to considerable correspondence on the point, to be a somewhat elastic term, such as a quarter of wheat, because some Scotchmen in writing us concerning their bread refer to their pint as being 4 lbs.; another says 5 pints equal 20 lbs., which, of course, is the same thing; another says he thinks his pint is 4 lbs. 4 ozs.; and another says he found his pint 4 lbs. 6 ozs. This pint is in general use in Scotland, and is referred to there in exactly the same way as a pint would be in England, namely, without any qualifying prefix. The Winchester quart is about the same as a Scotch pint, and, although used extensively in laboratories throughout the kingdom, is not adopted even in Winchester for general use.

A quarter of wheat is even more elastic, and must often be mystifying to the baker who closely follows markets; and it is usually in the wheat quotations that he will find information and warning as to what to be prepared for in flour. He will see the same grade or brand of wheat quoted under its name at widely different prices on the same day; this is not due to differences in closeness of quotation, as one may be equal value to the other. This is due to the difference in the weight of the quarter, according to the position, whether "on spot" or "to arrive," and is understood between buyer and seller. There are variations in details, according to the country whence the wheat comes. Then, again, the Government returns concerning the prices of English wheat are made up per Imperial quarter of 480 lbs., but the wheat was probably sold by its "natural" weight, which may in cases vary to the extent of nearly 10 lbs. per bushel or 80 lbs. per quarter. A Winchester bushel, by which curiously we have seen American crop returns made, is about double an Imperial bushel. A gallon of water varies in weight, according to temperature; at 5 degs. F. more than given above it will weigh 90 grains less. A "pail" is a measure often spoken of by the baker, and even in letters of details to the author, and may mean anything; an ordinary 28-lb. lard pail will, however, hold about 3 gallons of water.

Degrees Centigrade.			
1575.	Pyrometrical	heating effect of	air-dried wood (20 per cent. water).
1675.	,,	,,	kiln-dried wood (10 per cent. water).
1750.	,,	,,	kiln-dried wood (without water).
1675.	,,	,,	gases from wood charcoal.
1750.	,,	,,	gases from coke.
1850.	,,	,,	gases from coal.
1750.	,,	,,	best air-dried turf (25 per cent. water).
2000.	,,	,,	best kiln-dried turf (without water).
1800.	,,	,,	air-dried fibrous lignite (brown coal).
2025.	,,	,,	kiln-dried fibrous lignite.
2200.	,,	,,	sand coal (5 per cent. water).
2350.	,,	,,	anthracite (5 per cent. water).
2450.	,,	,,	air-dried black charcoal.
2200.	,,	,,	air-dried red charcoal.
2350.	,,	,,	best air-dried peat charcoal.
2350.	,,	,,	good coke (10 per cent. water).
2400.	,,	,,	best coke (5 per cent. water).
2450.	,,	,,	best coke (no water).
1910.	,,	,,	alcohol burned in air.
2458.	,,	,,	carbon burned in air.
4521.	,,	,,	alcohol burned in oxygen.
6000.	,,	,,	carbons in electric arc lamps.
9873 (17803 F.)	,,	,,	carbon burned in oxygen.

THERMOMETRICAL SCALES.

Table showing the relative Proportions of the Fahrenheit, Reaumur, and Centigrade Thermometrical Scales.

Fahr.	Reaum.	Centig.	Fahr.	Reaum.	Centig.	Fahr.	Reaum.	Centig.	Fahr.	Reaum.	Centig.	Fahr.	Reaum.	Centig.
350	141·3	176·6	272	106·6	133·3	194	72·0	90·0	116	37·3	46·6	38	2·6	3·3
349	140·8	176·1	271	106·2	132·7	193	71·5	89·4	115	36·8	46·1	37	2·2	2·7
348	140·4	175·5	270	105·7	132·2	192	71·1	88·8	114	36·4	45·5	36	1·7	2·2
347	140·	175	269	105·3	131·6	191	70·6	88·3	113	36·0	45·0	35	1·3	1·6
346	139·5	174·4	268	104·8	131·1	190	70·2	87·7	112	35·5	44·4	34	0·8	1·1
345	139·1	173·8	267	104·4	130·5	189	69·7	87·2	111	35·1	43·8	33	0·4	0·5
344	138·6	173·3	266	104	130·	188	69·3	86·6	110	34·6	43·3	32	0·0	0·0
343	138·2	172·7	265	103·5	129·4	187	68·8	86·1	109	34·2	42·7	31	— 0·4	— 0·5
342	137·7	172·2	264	103·1	128·8	186	68·4	85·5	108	33·7	42·2	30	— 0·8	— 1·1
341	137·3	171·6	263	102·6	128·3	185	68·0	85·0	107	33·3	41·6	29	— 1·3	— 1·6
340	136·8	171·1	262	102·2	127·7	184	67·5	84·4	106	32·8	41·1	28	— 1·7	— 2·2
339	136·4	170·5	261	101·7	127·2	183	67·1	83·8	105	32·4	40·5	27	— 2·2	— 2·7
338	136·	170	260	101·3	126·6	182	66·6	83·3	104	32·0	40·0	26	— 2·6	— 3·3
337	135·5	169·4	259	100·8	126·1	181	66·2	82·7	103	31·5	39·4	25	— 3·1	— 3·8
336	135·1	168·8	258	100·4	125·5	180	65·7	82·2	102	31·1	38·8	24	— 3·5	— 4·4
335	134·6	168·3	257	100·	125·	179	65·3	81·6	101	30·6	38·3	23	— 4·0	— 5·0
334	134·2	167·7	256	99·5	124·4	178	64·8	81·1	100	30·2	37·7	22	— 4·4	— 5·5
333	133·7	167·2	255	99·1	123·8	177	64·4	80·5	99	29·7	37·2	21	— 4·8	— 6·1
332	133·3	166·6	254	98·6	123·3	176	64·0	80·0	98	29·3	36·6	20	— 5·3	— 6·6
331	132·8	166·1	253	98·2	122·7	175	63·5	79·4	97	28·8	36·1	19	— 5·7	— 7·2
330	132·4	165·5	252	97·7	122·2	174	63·1	78·8	96	28·4	35·5	18	— 6·2	— 7·7
329	132·	165·	251	97·3	121·6	173	62·6	78·3	95	28·0	35·0	17	— 6·6	— 8·3
328	131·5	164·4	250	96·8	121·1	172	62·2	77·7	94	27·5	34·4	16	— 7·1	— 8·8
327	131·1	163·8	249	96·4	120·5	171	61·7	77·2	93	27·1	33·8	15	— 7·5	— 9·4
326	130·6	163·3	248	96·	120·	170	61·3	76·6	92	26·6	33·3	14	— 8·0	—10·0
325	130·2	162·7	247	95·5	119·4	169	60·8	76·1	91	26·2	32·7	13	— 8·4	—10·5
324	129·7	162·2	246	95·1	118·8	168	60·4	75·5	90	25·7	32·2	12	— 8·8	—11·1
323	129·3	161·6	245	94·6	118·3	167	60·0	75·0	89	25·3	31·6	11	— 9·3	—11·6
322	128·8	161·1	244	94·2	117·7	166	59·5	74·4	88	24·8	31·1	10	— 9·7	—12·2
321	128·4	160·5	243	93·7	117·2	165	59·1	73·8	87	24·4	30·5	9	—10·2	—12·7
320	128·	160·	242	93·3	116·6	164	58·6	73·3	86	24·0	30·0	8	—10·6	—13·3
319	127·5	159·4	241	92·8	116·1	163	58·2	72·7	85	23·5	29·4	7	—11·1	—13·8
318	127·1	158·8	240	92·4	115·5	162	57·7	72·2	84	23·1	28·8	6	—11·5	—14·4
317	126·6	158·3	239	92·	115·	161	57·3	71·6	83	22·6	28·3	5	—12·0	—15·0
316	129·2	157·7	238	91·5	114·4	160	56·8	71·1	82	22·2	27·7	4	—12·4	—15·5
315	125·7	157·2	237	91·1	113·8	159	56·4	70·5	81	21·7	27·2	3	—12·8	—16·1
314	125·3	156·6	236	90·6	113·3	158	56·0	70·0	80	21·3	26·6	2	—13·3	—16·6
313	124·8	156·1	235	90·2	112·7	157	55·5	69·4	79	20·8	26·1	1	—13·7	—17·2
312	124·4	155·5	234	89·7	112·2	156	55·1	68·8	78	20·4	25·5	0	—14·2	—17·7
311	124	155·	233	89·3	111·6	155	54·6	68·3	77	20·0	25·0	— 1	—14·6	—18·3
310	123·5	154·4	232	88·8	111·1	154	54·2	67·7	76	19·5	24·4	— 2	—15·1	—18·8
309	123·1	153·8	231	88·4	110·5	153	53·7	67·2	75	19·1	23·8	— 3	—15·5	—19·4
308	122·6	153·3	230	88·	110	152	53·3	66·6	74	18·6	23·3	— 4	—16·0	—20·0
307	122·2	152·7	229	87·5	109·4	151	52·8	66·1	73	18·2	22·7	— 5	—16·4	—20·5
306	121·7	152·2	228	87·1	108·8	150	52·4	65·5	72	17·7	22·2	— 6	—16·8	—21·1
305	121·3	151·6	227	86·6	108·3	149	52·0	65·0	71	17·3	21·6	— 7	—17·3	—21·6
304	120·8	151·1	226	86·2	107·7	148	51·5	64·4	70	16·8	21·1	— 8	—17·7	—22·2
303	120·4	150·5	225	85·7	107·2	147	51·1	63·8	69	16·4	20·5	— 9	—18·2	—22·7
302	120·	150·	224	85·3	106·6	146	50·6	63·3	68	16·0	20·0	—10	—18·6	—23·3
301	119·5	149·4	223	84·8	106·1	145	50·2	62·7	67	15·5	19·4	—11	—19·1	—23·8
300	119·1	148·8	222	84·4	105·5	144	49·7	62·2	66	15·1	18·8	—12	—19·5	—24·4
299	118·6	148·3	221	84·	105·	143	49·3	61·6	65	14·6	18·3	—13	—20·0	—25·0
298	118·2	147·7	220	83·5	104·4	142	48·8	61·1	64	14·2	17·7	—14	—20·4	—25·5
297	117·7	147·2	219	83·1	103·8	141	48·4	60·5	63	13·7	17·2	—15	—20·8	—26·1
296	117·3	146·6	218	82·6	103·3	140	48·0	60·0	62	13·3	16·6	—16	—21·3	—26·6
295	116·8	146·1	217	82·2	102·7	139	47·5	59·4	61	12·8	16·1	—17	—21·7	—27·2
294	116·4	145·5	216	81·7	102·2	138	47·1	58·8	60	12·4	15·5	—18	—22·2	—27·7
293	116·	145·	215	81·3	101·6	137	46·6	58·3	59	12·0	15·0	—19	—22·6	—28·3
292	115·5	144·4	214	80·8	101·1	136	46·2	57·7	58	11·5	14·4	—20	—23·1	—28·8
291	115·1	143·8	213	80·4	100·5	135	45·7	57·2	57	11·1	13·8	—21	—23·5	—29·4
290	114·6	143·3	212	80·0	100·0	134	45·3	56·6	56	10·6	13·3	—22	—24·0	—30·0
289	114·2	142·7	211	79·5	99·4	133	44·8	56·1	55	10·2	12·7	—23	—24·4	—30·5
288	113·7	142·2	210	79·1	98·8	132	44·4	55·5	54	9·7	12·2	—24	—24·8	—31·1
287	113·3	141·6	209	78·6	98·3	131	44·0	55·0	53	9·3	11·6	—25	—25·3	—31·6
286	112·8	141·1	208	78·2	97·7	130	43·5	54·4	52	8·8	11·1	—26	—25·7	—32·2
285	112·4	140·5	207	77·7	97·2	129	43·1	53·8	51	8·4	10·5	—27	—26·2	—32·7
284	112·	140·	206	77·3	96·6	128	42·6	53·3	50	8·0	10·0	—28	—26·6	—33·3
283	111·5	139·4	205	76·8	96·1	127	42·2	52·7	49	7·5	9·4	—29	—27·1	—33·8
282	111·1	138·8	204	76·4	95·5	126	41·7	52·2	48	7·1	8·8	—30	—27·5	—34·4
281	110·6	138·3	203	76·0	95·0	125	41·3	51·6	47	6·6	8·3	—31	—28·0	—35·
280	110·2	137·7	202	75·5	94·4	124	40·8	51·1	46	6·2	7·7	—32	—28·4	—35·5
279	109·7	137·2	201	75·1	93·8	123	40·4	50·5	45	5·7	7·2	—33	—28·8	—36·1
278	109·3	136·6	200	74·6	93·3	122	40·0	50·0	44	5·3	6·6	—34	—29·3	—36·6
277	108·8	136·1	199	74·2	92·7	121	39·5	49·4	43	4·8	6·1	—35	—29·7	—37·2
276	108·4	135·5	198	73·7	92·2	120	39·1	48·8	42	4·4	5·5	—36	—30·2	—37·7
275	108·	135·	197	73·3	91·6	119	38·6	48·3	41	4·0	5·0	—37	—30·6	—38·3
274	107·5	134·4	196	72·8	91·1	118	38·2	47·7	40	3·5	4·4	—38	—31·1	—38·8
273	107·1	183·8	195	72·4	90·5	117	37·7	47·2	39	3·1	3·8	—39	—31·5	—39·4
												—40	—32·	—40·

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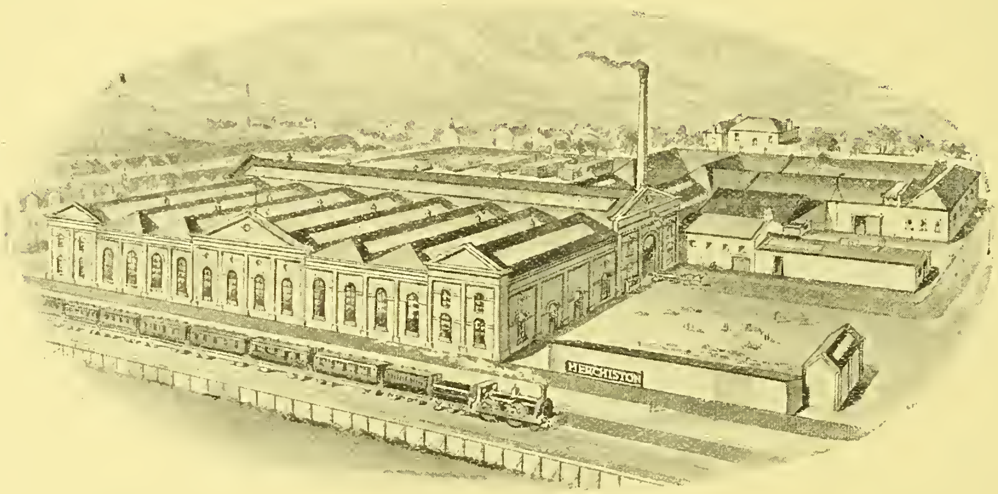

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